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1933, No. 4 DECEMBER 27

COPEIA

A JOURNAL OF COLD BLOODED VERTEBRATES

Established in 1913

THE TWENTIETH ANNIVERSARY NUMBER

PUBLISHED BY

THE AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS

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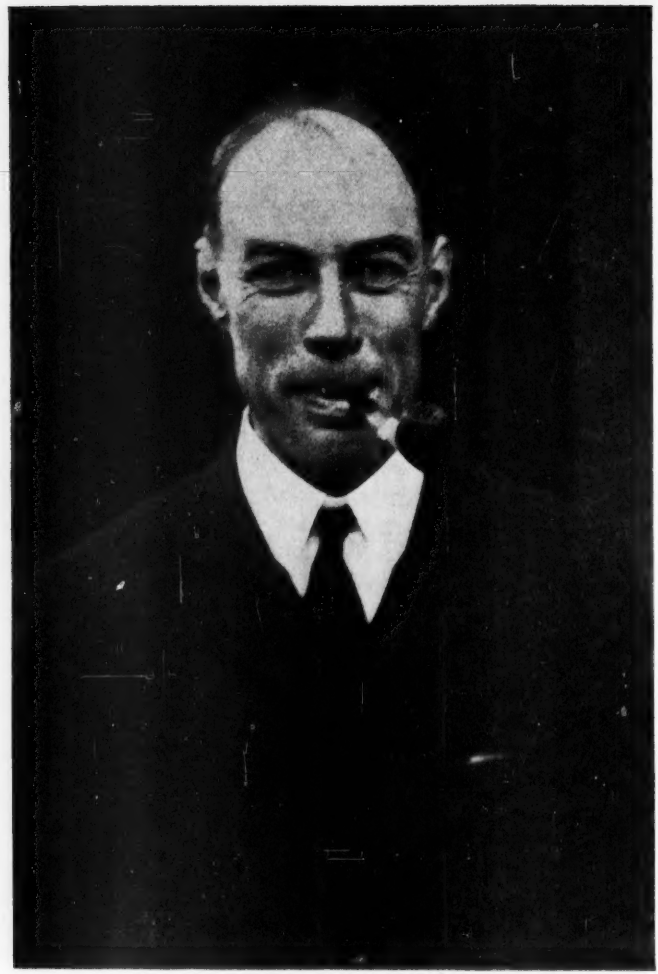


JOHN TREADWELL NICHOLS, *Founder of COPEIA,*
To whom this Twentieth Anniversary Number of the
Journal is Dedicated

New York, Dec. 27, 1913. No. 1.

Published by the contributors to advance the Science of cold-blooded vertebrates.

UNDER this heading appeared five short articles on ichthyology and herpetology. The authors were: H. W. Fowler; Dwight Franklin; R. J. Phillips and H. W. Fowler; J. T. Nichols, and W. DeW. Miller. The publication consisted of a folder of four printed pages. At the end appeared "Edited by J. T. Nichols, American Museum of Natural History".

The present number of COPEIA is intended to commemorate the publication of the first number, and to felicitate the founder of the journal. COPEIA has indeed advanced the science of cold-blooded vertebrates. There is manifest a great increase in activity since 1913, for which this journal and the Society which it presaged, and for which it opened the way, is, in large part, responsible.

JOHN TREADWELL NICHOLS founded COPEIA. With the 18th issue, May 15, 1915, he doubled the size of the journal. He cared for its editing and publication from the start until, ten years later, December 31, 1923, the 125th issue appeared, the last one he edited. The AMERICAN SOCIETY OF ICHTHYOLOGISTS AND HERPETOLOGISTS then assumed the responsibilities, and COPEIA became the official journal of the Society which had been fostered by it. The interest of the founder was not lessened by the change of responsibility, and many a financial crisis in the later career of COPEIA has been alleviated by his ready and generous help.

Therefore the Society and the present editors wish to show their appreciation by dedicating this number, with which COPEIA enters its 21st year, to its founder, JOHN TREADWELL NICHOLS, with all good wishes, felicitations, and congratulations appropriate on this anniversary.—E. R. DUNN, *Haverford College, Haverford, Pennsylvania.*

Anthias nicholsi, a New Fish Taken off Virginia in the Deep-Water Trawl Fishery[1]

By F. E. Firth

THE winter of 1932-33 yielded a number of rare fishes from off the Virginia Capes as a result of a combing of these off-shore grounds bordering the continental shelf and Gulf Stream, by a large number of trawlers.

I was indeed fortunate in being stationed at Norfolk, Virginia, during this period and was thereby able to collect some unusual and rare fishes which I observed as the boats were unloading their fares at the various docks. I was also aided in this by the fishermen, most of whom I knew rather well, and who added many strange fish to the collection.

Among those fish which I first had an opportunity to study, last spring, I came upon three specimens which appeared to be exact duplicates of one which I had collected a year previous. I had been unable to identify this specimen specifically, and had stored it away for just such a moment as this.

After a careful examination of the specimens I found them identical, and from a study of their characteristics, I was able to place them in the genus *Anthias*. I could not, however, find a fish with which it would check. I knew then that I had a new species. The following is the complete information on it.

The first specimen of this new anthiine, now No. 12337, American Museum of Natural History, was taken in March 1932, 50 miles east-half-north of Cape Henry, Virginia, by the trawler "Beauty of St. Joseph." The other three specimens were caught in a deep-water otter trawl in 40 to 50 fathoms of water, east by south of Chesapeake Light Vessel on January 20, 1933, by the trawler "Grace F." One of the latter is the holotype, Cat. No. 92936, U. S. National Museum, a specimen 150 mm in standard length.

Anthias ***nicholsi,*** new species

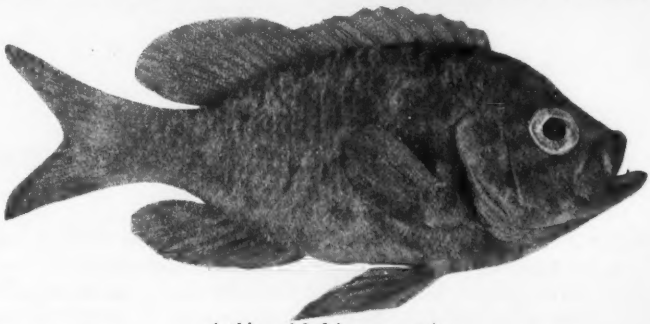
Diagnosis.—Interorbital region and most of snout and maxillary scaly. Lateral line forming an angle below the posterior dorsal rays. Caudal forked. Four scales between first dorsal spine and lateral line; two between middle dorsal spines and lateral line. Dorsal with 15 soft rays; anal with 7. Ventral long and pointed, but without filamentous rays, reaching anterior soft anal rays. Eye about equal to snout. Head about one-third standard length. Color more or less rose-red with light yellow stripes and markings.

Description of the holotype, No. 92936.—Total length, 191 mm. Length to base of caudal, 150 mm. Depth in standard length, 2.3; head, 3.0. Eye in head, 3.3; snout, 3.3; interorbital, 4.0; maxillary, 1.9; greatest width of body (at back of head), 1.7; length of peduncle (from anal origin), 1.7; length of pectoral, 1.4; of ventral, 0.9; longest dorsal spine, 2.3; longest dorsal ray, 1.8; longest anal ray, 1.9; caudal lobe, 1.1.

[1] Published by permission of the U. S. Commissioner of Fisheries.

Dorsal rays X, 15; anal III, 7; scales in lateral line, 33. Twenty-nine gill rakers on the lower limb of the anterior arch, 8 on the upper.

Profile slightly concave, humped at the nape. Mouth oblique; the lower jaw slightly projecting; maxillary scarcely reaching to below middle of the eye. Narrow bands of small teeth in the jaws; the outer series somewhat larger; several moderately developed canines in the front of the jaws, the largest of these near the middle of the lower jaw. Conspicuous bands of teeth on vomer and palatines; tongue mostly smooth. Dorsal fin beginning above the upper corner of the gill cleft, without a notch; spines of approximately equal length after the third, the first two shorter; rays



Anthias nicholsi, new species
Retouched photo by F. E. Firth

longer than the spines. Pectoral fin bluntly pointed, not quite reaching to above anal origin. Ventral fin reaching to the first soft rays of anal. Caudal forked for a little more than half its length; the lobes pointed but not filamentous. Lateral line curving upward and running close to the back, then down to the center of peduncle where it forms an angle under the posterior dorsal rays, thence straight back to caudal fin.

In formalin the specimen is pale in color with pink shades on body and fins. The end of the lower jaw is strongly pink. The margin of the dorsal and most of the anal are bright yellow. Outer margin of ventral pink; center of fin bright yellow; inner angle pale. A yellow stripe runs backward below the eye to the base of the pectoral, and another extends from the back of the eye to the margin of the opercle. There is an olive blotch in the middle of the back at the base of the first dorsal spine. When fresh this spot was deep blue; the head showed more or less radiating stripes of yellow and red; and caudal was whitish, margined all around with red; the body had 3 or 4 more or less well defined lengthwise yellow stripes, and was silvery white below; the body and fins were otherwise marked with pink and yellow.

Relationship.—This species is rather remotely related to *Anthias asperilinguis* Günther from the Atlantic coast of South America[2], from which it differs in having a decidedly smaller eye and differently shaped, nonfilamentous ventral and caudal fins. It has been compared with the types

[2] Figured by Boulenger in *Catalogue of the Fishes of the British Museum*, Ed. 2, Vol. 1, pl. 13.

of *Anthias louisi* Bean and *Anthias tenuis* Nichols from Bermuda, much smaller specimens which are both in the American Museum of Natural History. The latter is a decidedly slenderer fish, the former has a shorter snout, shorter ventrals, less forked caudal, etc. Both these species have recently been figured by Beebe and Tee-Van[2].

Dedication.—I have named this deep-water bass for John Treadwell Nichols, Curator of Recent Fishes, American Museum of Natural History, in deep admiration of his scientific achievements.

U. S. Bureau of Fisheries, Harvard Biological Laboratories, Cambridge, Massachusetts.

Deep-Sea Stomiatoid Fishes

One New Genus and Eight New Species[1]

By William Beebe

THIS is the third installment of descriptions of new forms of deep-sea fish taken on the Bermuda Oceanographic Expeditions of the Department of Tropical Research of the New York Zoological Society. They were all taken within the eight-mile circle whose center is at 32° 12′ North Latitude and 64° 36′ West Longitude, 9¼ miles south-southwest of Nonsuch Island, Bermuda.

The descriptions are published here in advance of the ecological studies of the stomiatoid fishes which will soon appear.

The drawings are by Edward Delano.

Family Astronesthidae

1. *Neonesthes* ***nicholsi,*** sp. nov.

(Fig. 1)

Type.—Department of Tropical Research No. 17,529; Bermuda Oceanographic Expeditions of the New York Zoological Society; Net 824; September 1, 1930; 9 miles south of Nonsuch Island, Bermuda; 800 fathoms; standard length 144 mm.

Measurements and Counts.—Total length 156 mm; standard length 144 mm; depth 24 mm (in length 6); head 27 mm (in length 5.3); eye 5 mm (in head 5.4); snout 4.5 mm (in head 6); snout to pelvic 60 mm; snout to dorsal 78 mm; pectoral rays 8; pectoral length 13 mm; pelvic rays 7; pelvic length 12 mm; dorsal rays 10; anal rays 26; postorbital 6 mm (in head 4.5); suborbital extension 2.2 mm; barbel 98 mm (3.6 times head). Serial photopheres: lateral series, O–V 15, V–A 19; ventral series, I–P 10, P–V 16, V–A 19, A–C 14. Gill-rakers in lower half of first arch 31.

General Description.—In general appearance and proportions this fish closely resembles *Neonesthes macrolychnus* Regan and Trewavas.

[2] Field Book Shore Fishes Bermuda, 1933: 137 and 138.
[1] Contribution, New York Zoological Society, Department of Tropical Research, No. 425.

The teeth are arranged as follows in the left side of the mouth: Premaxillary, 9 teeth on the ridge of the jaw, each tooth except the last followed by 2 smaller, exterior teeth, giving a total of 25; maxillary, total number, 39, the ridge teeth of the posterior part of the jaw alternating with 2 or 3 small, external teeth as in the premaxillary; mandible, total number, 39, the ridge teeth alternating irregularly with 1 or more exterior teeth throughout the length of the jaw. In the right side of the mouth the teeth of both jaws number from 3 to 6 fewer in each group than in the left side. All of the teeth are similar, being short, slender, tapering and erect. There is a pair of teeth on the vomer and 2 or 3 teeth are on each palatine. The gill-rakers are much longer than the teeth, strong and slender.

Fig. 1. *Neonesthes nicholsi*, sp. nov. End of barbel, ×6.9.

The paired fins are moderately short, but sturdily developed. The pelvics are inserted in front of the middle of the body, the dorsal slightly behind; the latter fin ends well in front of the anal. The caudal is deeply forked, with the lower lobe conspicuously longer than the upper. The dorsal adipose is small, inserted above the eighth from the last anal ray. A very shallow ventral adipose is present, extending from a short distance behind the pelvics to the anus.

The postorbital proper is a rough oval, longer than the eye and slightly broader anteriorly than posteriorly. Projecting forward from this organ is a narrow, finger-like extension which lies directly beneath the eye, with the luminous matter entirely exposed except for the most posterior corner. This process and the anterior part of the large, oval portion are separated from the eye by a triangle of smooth black skin, continuous with that of the light organ's socket. The antorbital is rudimentary—a round papilla beneath the lower, front corner of the eye, completely covered with black skin.

The barbel is 3.6 times as long as the head, or two-thirds the length of the fish. The stem is completely sheathed in thin, brown skin sprinkled irregularly with light spots, the distal three raised on short stalks. The small, terminal bulb is ovoid and measures 2.2 mm in length. Immediately proximal to the base of the bulb arises a posterior, translucent filament 11 mm long. Proximal to this is a small, dark, rounded organ with an anterior, tiny, stalked, white body and with a minute, photophore-like, white spot on each side. This terminal region of the stem and the entire bulb are enclosed in a translucent sheath, continuous with the outer, pigmented covering of the stem and pierced only by the posterior filament.

Discussion.—This species differs from both of the previously recorded

species, *N. macrolychnus* Regan and Trewavas 1929 and *N. microcephalus* Norman 1930, in the greater length of the barbel (4.5 times length of head, not 0.6 to 2.3), in the presence of a long filament at the base of the bulb, and in the smaller eye (5.4 in head, not 4 to 5). In other proportions and in fin-ray counts it is identical with *N. macrolychnus,* these two species differing from *N. microcephalus* in having longer heads (4.5 to 5.5, not 6.3, in length) and several more anal rays (25 to 28, not 22 to 23).

N. macrolychnus is known from seven specimens, from 35 to 150 mm, taken from the North and South Atlantic, westward to the Bahamas, eastward nearly to Cape Verde. The two specimens of *N. microcephalus* measure 145 and 148 mm, and were taken in the same net, from off Southwest Africa.

In addition to the type specimen of *N. nicholsi* the Bermuda collection contains seven other specimens measuring from 26 to 138 mm. The barbel is broken off short in one specimen and, in the youngest fish, is very short, simple and scarcely pigmented. All of the others, however, have at the base of the bulb a tentacle which increases in relative size with the length of the fish. Detailed descriptions of the specimens at their various stages of development will be presented in a forth-coming installment of the monograph on the deep-sea fishes of Bermuda.

Neonesthes nicholsi is named in honor of my good friend and most excellent ichthyologist, Dr. JOHN T. NICHOLS of the American Museum of Natural History.

Family MELANOSTOMIATIDAE

2. *Bathophilus* ***altipinnis,*** sp. nov.

(Fig. 2)

Type.—Department of Tropical Research No. 10,885; Bermuda Oceanographic Expeditions of the New York Zoological Society; Net 214; June 24, 1929; 8 miles south of Nonsuch Island, Bermuda; 800 fathoms; standard length 63 mm.

Measurements and Counts.—Total length 70.4 mm; standard length 63 mm; depth 10.7 mm (in length 5.9); head 12.6 mm (in length 5); eye 2.4 mm (in head 5.3); snout 3.3 mm (in head 3.8); pectoral rays 24; pectoral length 14.3 mm; pelvic rays 15; pelvic length 17.1 mm; snout to pelvic 29.5 mm; dorsal rays 15; anal rays 15; caudal rays 23; caudal length 7.4 mm; suborbital length 2.3 mm (in head 5.5); barbel length 21.4 mm (in standard length 2.9). Serial photophores: lateral series, O–V 13, V–A 11; ventral series, I–P 5, P–V 13, V–A 11, A–C 10.

General Description.—The resemblance of this species to *B. nigerrimus* and *B. proximus* precludes the necessity of a detailed description. In the freshly caught specimen the barbel, which is undoubtedly complete, was slender and pure white, tapering very gradually and ending in two short, slender filaments.

The pectorals have 24 rays in the left and 25 in the right fin. On each side the anterior ray is slightly separated from its fellow, while another slight but bilaterally symmetrical gap occurs between the fifth and sixth rays.

There are 10 premaxillary teeth on the left and 9 on the right side. On each side the second, first and fifth are successively larger, in that order. About 40 small denticles are scattered along the maxillary, the posterior 10 scarcely projecting from the bone. In the mandible, 2 fangs are followed by 8 smaller teeth, the second fang largest, then in succession the first, fourth and third. The vomer is edentulous. There are 2 curved teeth on each palatine, the anterior one the larger. The mandibular symphysis projects as a sharp keel, far ahead of the teeth.

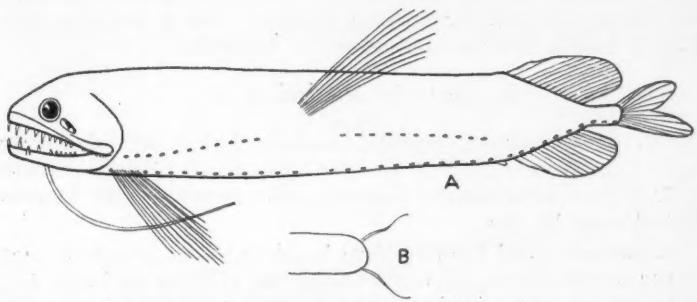


Fig. 2. *Bathophilus altipinnis,* sp. nov. A, lateral view, ×1.5. Exact number of pectoral rays, 24; of pelvic rays, 15. B, tip of barbel, greatly enlarged.

The suborbital photophore is of a flattened, oval shape, and when fully rolled up into view exposes two luminous areas, a small, inferoposterior triangle and a large anterior area, the extreme upper front of which shows in the preserved specimen a white surface, which in the fresh specimen is deep red.

Discussion.—This species is closest to *B. nigerrimus* Giglioli and *B. proximus* Regan and Trewavas, having in common with them a moderately deep body (depth 5 to 6 in length), pelvic fins inserted extremely high on the sides of the body, about equidistant from dorsal and ventral profiles, and a large number of rays in the pectoral fins (16 to 50).

From *B. nigerrimus* it differs principally as follows: In the smaller number of rays in the paired fins (pectoral 24 to 25, not 34 to 50, pelvic 15, not 18 to 26); in the shorter barbel, contained nearly 3 times in the length and having 2 short terminal filaments (the most complete barbel of Balducci's[1] series is contained 1.8 times in the length, that in the figure of Regan and Trewavas[2] 1.3, no filaments being mentioned in either case; in Giglioli's[3] type the barbel was entirely missing); in the complete partitioning of the suborbital into anterior and posterior luminous triangles and in the absence of a "small, pearl-like protuberance below it"; in the shorter head (contained 5 times in the length, not 4 to 4.5). *B. nigerrimus* is known from about 25 specimens up to 111 mm in length, taken in the

[1] Balducci, Ann. Inst. Ocean. Paris, 7 (3), 1915: 1–15, pl. 1.
[2] Regan and Trewavas, Danish "Dana" Exp. Ocean. Reports, No. 6, 1930: 66, pl. 3, fig. 2.
[3] Giglioli, Pelagos, saggi sulla vita e sui prodotti del mare. Tip. Roy. Inst. Sordo. Muti, Geneva, 1884: 261, fig.

Caribbean Sea, the Gulf of Mexico, the Atlantic and the Mediterranean.

From *B. proximus* the new species differs in the greater number of rays in the pectoral fins (24 to 25, not 16 to 19); in the greater number of photophores in the lateral series (O–V 13, not 10; V–A 11, not 10) and in the smaller number in the ventral series (V–A 11, not 13); in the shorter barbel with 2 terminal filaments (contained almost 3 times in the length, not 2.4, as shown in the figure of Regan and Trewavas[1]); in the smaller size and peculiar partition of the suborbital (the figure just mentioned shows a simple oval, larger than the eye; in the present specimen the organ about equals the eye). *B. proximus* is known from a single specimen, 55 mm in length, from the Atlantic, west of Bermuda.

3. *Eustomias* ***satterleei,*** sp. nov.

(Fig. 3)

Type.—Department of Tropical Research No. 13,457; Bermuda Oceanographic Expeditions of the New York Zoological Society; Net 455; September 10, 1929; 8 miles south of Nonsuch Island, Bermuda; 1000 fathoms; standard length 140 mm.

Measurements and Counts.—Total length 145.5 mm; standard length 140 mm; depth 11.9 mm (in length 11.8); head 17.2 mm (in length 8.1); eye 3.2 mm (in head 5.4); interorbital 3.2 mm (in head 5.4); postorbital 2.5 mm (in head 6.9); barbel, to tip of bulb without distal filament, 13.5 mm (in head 1.3); pectoral rays 2; pectoral length 11 mm; pelvic rays 7; pelvic length 12 mm; snout to pelvic 72 mm; dorsal rays 22; anal rays 41. Serial photophores: lateral series: O–V 27, V–A 16; ventral series, I–P 7, P–V 28, V–A 16 (5 over anal fin), A–C 20. On the right side of the fish there is one more P–V and one fewer V–A photophores in both series, and 21 A–C organs.

General Description.—In form this fish is typical of those eustomiads with branched barbels, all of which have the usual slender, tapering bodies, but comparatively rounded heads. There are 11 teeth in the left premaxillary, the second, first and sixth largest, in that order, the third and seventh small and exterior. The maxillary denticles are exceedingly minute, and number about a dozen. In the left mandibular ramus are 18 teeth, the third, tenth, ninth, eighth and first the largest, respectively; the sixth and seventh are small and exterior. The teeth of the right side of both jaws are fewer by 1 or 2; on both sides there are several minute replacement teeth. The vomer and palatine are toothless; 3 pairs of well developed, curved fangs are set on the basibranchials.

The pectoral fin is rather short and quite functionless for either locomotion or illumination. The bases of the two rays are tightly sheathed in a common covering of skin, making them appear as a single unit proximally. The pelvic is fully webbed and considerably longer, but does not reach the origin of the anal fin.

The barbel (14 mm in length to tip of bulb, exclusive of appendage) resembles those of both *E. macronema* Regan and Trewavas and *E. frondosus* Regan and Trewavas. In common with these it has three posterior

[1] Regan and Trewavas, *loc. cit.*: 66, pl. 3, fig. 3.

branches, of which the median is terminally bulbless and shorter than the lateral ones; similar also is the main barbel stem, which is pigmented clear to the base of the large bulb. In the details of its structure however, the barbel of *E. satterleei* is quite distinct and more elaborate than either of the closely related species: The bulb (6.1 mm in length) is symmetrical, of greatest diameter distally, and has a single, rather thick, terminal appendage with two pairs of short filaments. The proximal pair is lateral, one

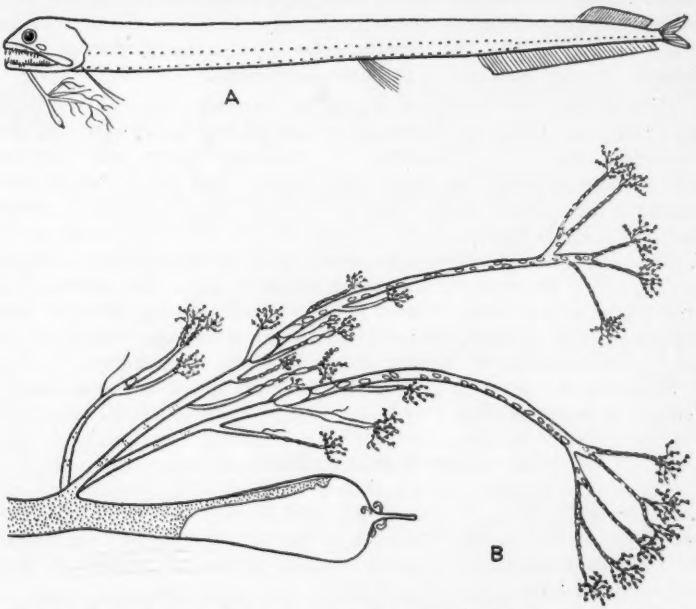


Fig. 3. *Eustomias satterleei*, sp. nov. A, lateral view, ×0.75. B, distal half of barbel, greatly enlarged.

filament on each side of the base of the appendage; the distal two arise only slightly beyond these, on the anterior and posterior sides, respectively. The pigment of the barbel stem extends over three-quarters of the posterior face of the bulb in a narrow, forked tongue.

The branches arise slightly above the middle of the total length of the barbel (exclusive of the distal appendage). The central branch is about two-fifths as long as the lateral ones, forking into unequal prongs at about the middle of its length. Distally the prongs divide and subdivide again and again into numerous fine filaments, all strung with minute, round, luminous bodies. A single, large, oval, luminous bead is enclosed in the main branch stem, immediately distal to the main fork. Below the latter is a short, thread-like filament. The lateral branches are prolonged elaborations of the median branch: They extend far beyond the tip of the barbel and the principal fork occurs four-fifths of the way to their ends; in both

branches the anterior prong has three chief divisions, the posterior two. These short terminal divisions subdivide endlessly into minutely beaded filaments, just as in the central branch. Along the median portion of the lateral branches a number of secondary branches (7 on the left branch, 4 on the right) of varying lengths and thicknesses is given off, all terminating in the usual tufts of filaments. These small branches, as well as all of the distal three-fifths of the lateral branches and the terminal divisions, are beaded with oval luminous bodies, enlarged counterparts of the fine distal spheres, the most proximal very large, equal to the inner diameter of that section of the branch. The three branches have a few patches of sparse pigment, but only proximal to the first subdivisions.

Discussion.—This species is closest to *Eustomias macronema* Regan and Trewavas 1930 in photophore count and general barbel plan. In body proportions, however, it resembles *E. frondosus* Regan and Trewavas 1930, as both the latter species and the present form differ from *E. macronema* in their deeper trunk (depth 8 to 12 in length, not 13.5), longer head (6.3 to 8.7 in length, not 9.5), and larger eye (5 to 5.4 in head, not 7). *E. frondosus* differs from both the other species in the smaller number of O–V and P–V photophores (24 to 26, not 28 to 29). The barbels of all three species are perfectly distinct in their details, having different distal appendages and variously proportioned branches. As has been said, the barbel of *E. satterleei* is the most elaborate of the three forms.

Named in honor of a Patron of the New York Zoological Society, Herbert L. Satterlee, Esq.

4. *Melanostomias* ***bulbosus,*** sp. nov.
(Fig. 4)

Type.—Department of Tropical Research No. 10,235; Bermuda Oceanographic Expeditions of the New York Zoological Society; Net 136; May 30, 1929; 9 miles southeast of Nonsuch Island, Bermuda; 700 fathoms; standard length 222 mm.

Measurements and Counts.—Total length 237 mm; standard length 222 mm; depth 25 mm (in length 8.9); head 33 mm (in length 6.7); eye 5.9 mm (in head 5.6); snout 5.3 mm (in head 6.2); suborbital 6.4 mm (in head 5.2); barbel length 34 mm (in head 1); snout to pelvic 145 mm; pectoral rays 5; pectoral length 17 mm; pelvic rays 7; pelvic length 33 mm; dorsal rays 14; anal rays 18. Serial photophores: lateral series, O–V 24, V–A 11; ventral series, I–P 8+3=11, P–V 24, V–A 14, A–C 9.

General Description.—In general form *Melanostomias bulbosus* is typical of the genus, with the body only moderately compressed and elongate, the profiles tapering gradually to a very slender peduncle, the head moderate, the snout rounded, and the jaws straight and even, set with large, bicuspid teeth. Each premaxillary has 8 teeth, the second, fourth and eighth longest, respectively; the maxillary teeth are in three groups, an anterior set of 6 long, straight fangs, a median group of 4 only half as large, and finally a row of 23 minute, oblique denticles. Each mandibular ramus holds 10 teeth, of which the first is moderately short, the second minute, and the third, sixth, fifth and tenth longest, in that order. The

teeth of both roof and floor of the mouth are strongly developed, 1 pair on the vomer, 5 teeth on each palatine and 2 pairs on the basibranchials. There is a small, white mass of luminous material inside the transparent base of each tooth.

The fully webbed pelvics, longer than the simple, unwebbed pectorals, barely reach the anal origin.

The cheek light is large and conspicuous, longer than the eye, and roughly triangular in shape with the apex directed posteriorly.

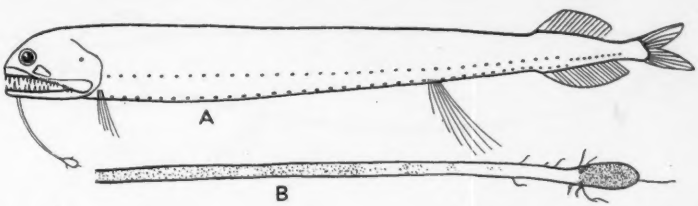


Fig. 4. *Melanostomias bulbosus,* sp. nov. A, lateral view, ×0.5. B, barbel, greatly enlarged.

The barbel equals the head in length. The stem is pigmented fairly solidly throughout its proximal two-thirds and from here to the end in sparse patches. The simple, oval bulb is brownish-black in color even in the preserved specimen, and shows no obviously luminous character. Its outer covering as well as that of the distal part of the stem has been slightly ruptured, so that it is impossible to count exactly the number of small filaments which arise from these two areas; however, on the bulb are clearly visible an anterior proximal tuft of two or three threads and a single distal filament; in addition at least half a dozen more processes are scattered near the base of the bulb.

Discussion.—This specimen is closest to *Melanostomias niger* Gilchrist and von Bonde 1924, which it resembles in having an ovate bulb at the end of the barbel instead of the terminal portion expanded and laterally compressed, as do the remaining species of the genus. In the present species, however, the barbel is only half as long as in *M. niger* although the two specimens are of about the same size, there are several short filaments attached to the bulb, there are fewer serial photophores (a total of 58 in the ventral series instead of 63, and in the lateral series 35 instead of 40) and there are 14 dorsal rays as in several other species of the genus instead of the 10 rays found in *M. niger.* The type of *Melanostomias niger,* which is the only known specimen, came from South Africa.

5. *Photonectes* ***bifilifer,*** sp. nov.
(Fig. 5)

Type.—Department of Tropical Research No. 15,146; Bermuda Oceanographic Expeditions of the New York oZological Society; Net 598; May 19, 1930; 9 miles south of Nonsuch Island, Bermuda; 800 fathoms; standard length 245 mm.

Measurements and Counts.—Total length 260 mm; standard length 245 mm; depth 37 mm (in length 6.6); head 35 mm (in length 7); eye 5 mm (in head 7); snout 6 mm (in head 5.8); postorbital 9 mm (in head 3.9); barbel length 11 mm (in head 3.2); snout to pelvic 156 mm; pectoral rays 2; pectoral length 55 mm; pelvic rays 7; length longest pelvic ray 75 mm; dorsal rays about 14; anal rays about 18; serial photophores: lateral series, O–V 38, V–A 13; ventral series, I–P 10, P–V 37, V–A 14, A–C 15.

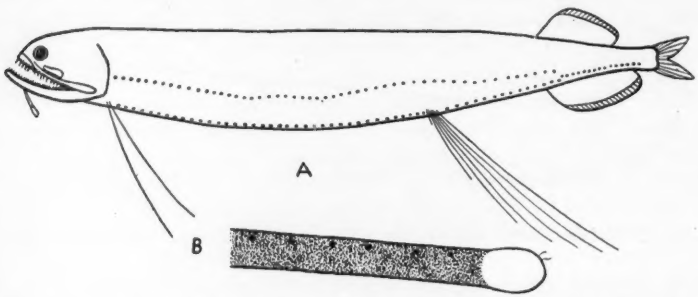


Fig. 5. *Photonectes bifilifer,* sp. nov. A, lateral view, ×0.4. B, barbel, greatly enlarged.

General Description.—In form this *Photonectes* is characteristic of the group of species which has the dorsal and anal fin membranes thick and black. The body is deep for a melanostomiatid and thickest towards the middle of its length, while the head is small, lower than the shoulders and somewhat concave dorsally.

In the left premaxillary are 6 teeth, the first very small, well separated from the succeeding 5 equal fangs. The left maxillary holds 16 depressible, erect teeth in graduated series of 4, 2, 3, 3 and 4; the posterior oblique denticles number about 35 and are very small and close-set. The maxillary teeth of the right side are slightly different in their grouping. In the left side of the mandible are 35, in the right side 38, teeth; they are in the usual *Photonectes*-like groups of from 3 to 5 only in the posterior part of the jaw and the teeth of each group decrease instead of increase in length from front to back. There is a single pair of teeth on the vomer and 5 teeth on each palatine. On the basibranchials are 6 pairs, increasing in length backwards.

The pectoral consists of 2 elongated, thread-like rays, widely separated at the base, over one and one-half times as long as the head. The pelvic, placed far back on the body, has the basal portion covered with a thick, black membrane similar to those which almost completely enclose the rays of the dorsal and anal. The most anterior pelvic ray is very short, scarcely projecting beyond the membrane, but the succeeding rays increase in length posteriorly, until the seventh reaches the caudal base.

The long postorbital is 1.8 times the diameter of the eye.

The barbel is about a third the length of the head; it has a thick, black

stem, four-fifths the length of the entire barbel, and a slightly enlarged, ovate, terminal bulb, whitish at the base in the fresh specimen, changing into rich lavender distally. There are two very short, thread-like filaments on the posterior surface near the tip. Along the posterior side of the stem is a row of half a dozen small photophores.

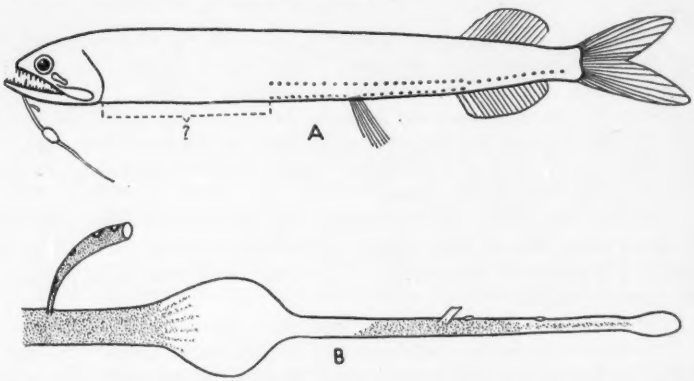


Fig. 6. *Photonectes cornutus,* sp. nov. A, lateral view, ×4.7. B, barbel, greatly enlarged.

Discussion.—In addition to the unique structure of the barbel *Photonectes bifilifer* differs from all other species of *Photonectes* in having the pectoral composed of 2 long, well developed rays, and in having 35 oblique teeth in the maxillary, instead of not more than 17 oblique, or 26 erect plus oblique teeth.

According to the classification of *Regan* and *Trewavas*[1] this species belongs in the group having the membranes of the dorsal and anal fins thick and black, and with 42 to 48 I–V photophores. Within this division, the presence of 2 pectoral rays and the short barbel with single terminal bulb bring it closest to the subgenus *Microchirichthys,* which includes *P. parvimanus* and *P. fimbria,* both described by Regan and Trewavas in 1930.[2]

6. *Photonectes* ***cornutus,*** sp. nov.
(Fig. 6)

Type.—Department of Tropical Research No. 17,875; Bermuda Oceanographic Expeditions of the New York Zoological Society; Net 842; September 4, 1930; 10 miles south of Nonsuch Island, Bermuda; 600 fathoms; standard length 19 mm.

Measurements and Counts.—Total length 23 mm; standard length 19 mm; depth 2.4 mm (in length 7.9); head 3 mm (in length 6.3); eye 0.7 mm (in head 4.3); snout 0.6 mm (in head 5); postorbital 0.7 mm (in head 4.3); barbel length 4.3 mm (head in barbel 1.4); pectoral rays 0; pelvic rays 7; pelvic length 1.9 mm; dorsal rays 15; anal rays 18. Serial photo-

[1] Regan and Trewavas, Danish "Dana" Exp. Ocean. Reports, No. 6, 1930: 119.
[2] *Loc. cit.*: 124–125.

phores: lateral series, O–V ?, V–A 12; ventral series, I–V ?, V–A 12, A–C 11.

General Description.—In spite of its small size, advanced adolescent characters are well developed in this young fish, the color being very dark brown and all of the light organs, teeth and fins appearing well or fully formed.

There are 8 teeth in each premaxillary, of which the fifth is the largest, and an equal number in the maxillary, 5 erect and 3 oblique; the mandible holds 15 teeth in each side, the sixth the longest; 2 pairs of teeth are set close together on the vomer, the 2 smaller being possibly replacement teeth only; 1 pair is located far back on the palatines; on the basibranchials there are altogether 12 teeth in 2 groups of 3 pairs each, the most posterior pair of each group being barely visible.

The pelvics are short, but have well developed rays and webs. The rays of the unpaired fins are soft, ragged and difficult to count, as usual in this genus. The caudal is still relatively very long, being more than a fifth of the standard length.

The postorbital is inconspicuous and about equals the eye in length.

The black stem of the barbel gives off a thick, short, black, club-shaped appendage posteriorly with several small, proximal photophores, two larger distal organs and a large pore at the extreme tip. Below this branch the stem expands into a large, white bulb, then narrows abruptly into a long, terminal filament, pigmented throughout most of its length, with several very small, roundish appendages and a flattened, irregularly rounded tip.

The number of I–V photophores is indeterminable, due to the damaged condition of the specimen in the region of the pectoral girdle. There is a pair of luminous spots, close together, on the tip of the snout and 2 more pairs on the anterior part of the floor of the mouth. The rudiments of a third pair are located in front of these, at the symphysis.

Comparison.—This species belongs to the subgenus *Photonectes* as characterized by Regan and Trewavas[1], composed of species with the I–V photophores numbering from 30 to 37, no pectoral fin, depth 6 to 9 in length, dorsal and anal relatively short with thin membranes and pelvics much nearer to the caudal fin than to the head. It is very close to *P. mirabilis* Parr 1927 from the Bahamas, but differs in the presence of a well developed, pigmented branch which springs posteriorly from the stem of the barbel in place of the small, white, luminous knob found in that position in *P. mirabilis*. There are also minor differences between the two species in the more rounded form of the bulb and the ovoid, not round, terminal swelling in the present species. Differences in the teeth and proportions as compared with Parr's 60 mm type may be attributed to age. Of the 18 mm specimen of *P. mirabilis* taken by the "Dana" off Cape Hatteras, Regan and Trewavas[2] say, "It is extremely similar to the type, except that the bulb of the barbel is as long as the stem and the translucent terminal part is less expanded, with larger white body." This statement

[1] Regan and Trewavas, Danish "Dana" Exp. Ocean. Reports, No. 6, 1930: 119.
[2] *Loc. cit.*: 123.

proves that the form of the barbel in the present specimen is not a juvenile character of *P. mirabilis*.

Family MALACOSTEIDAE

7. *Aristostomias* ***photodactylus***, sp. nov.
(Fig. 7)

Type.—Department of Tropical Research No. 10,932; Bermuda Oceanographic Expeditions of the New York Zoological Society; Net 213; June 24, 1929; 10 miles south of Nonsuch Island, Bermuda; 700 fathoms; standard length 84 mm.

Measurements and Counts (from the fresh specimen, unchanged after four years in preservative).—Total length 89 mm; standard length 84 mm; depth 12 mm (in length 7); head 17.5 mm (in length 4.8); mandible 20 mm (in length 4.2); eye 3.2 mm (in mandible 6.25); snout 4.9 mm (in mandible 4.1); snout to pelvic 44 mm; pectoral rays 10; pectoral length 12 mm; pelvic rays 6; pelvic length 15 mm; dorsal rays 15; anal rays 26; suborbital 2.4 mm (in eye 1.3); postorbital 1.9 mm. (in eye 1.7); barbel 29 mm (in length 2.9). Serial photophores: lateral series, O–V 17, V–A 17 (the last 5 in a close-set group); ventral series, I–P 8 (5+3), P–V 17 (6+4+4+3), V–A 13 (4+6+3), A–C 12 (the last 5 in a close-set group). Weight 4.2 grams; volume 4 cc; specific gravity 0.95.

General Description.—In form this specimen is typical of the genus: The body is heavy, parallel-sided, tapering hardly at all, much compressed. The thick head and the square, caudal-like dorsal and anal complete the solid, long, rectangular outline. The difference in depth at dorsal and pectoral is only 3 to 4. The line of the back extends straight to the front of the eye, then curves rapidly downward.

There are 8 premaxillary teeth in the left jaw and 9 in the right; in each case the third tooth is longest, the first next and the second small and external; the remaining premaxillary teeth are divided into two groups of 2 or 3 small teeth each. Each maxillary holds 25 to 27 small, oblique denticles. In the left mandibular ramus are 13 teeth, in the right 15, the first two on each side enormous fangs, each 4.5 mm in length and fitting into dermal grooves in the upper jaw. All of the mandibular teeth, as well as the third fang-like premaxillary, have the tips enlarged and barbed. The vomer is toothless. On each palatine is a series of 6 small teeth, and there are 4 pairs of somewhat larger ones on each of the first 2 basibranchials.

The pectorals are highly modified and must serve entirely as luminous organs. Each fin has an elevated, black, papilla-like base. Upon this the rays are arranged in a roughly semi-circular fashion around the lower half of an oval of luminous tissue. Each ray bears a greater or smaller mass of luminous matter which is chiefly concentrated in an elongate swelling near the ray's base, but a thin coating frequently extends to the tip. The rays themselves are pigmented throughout their length and can be traced through the midst of the basal luminous masses, or to one side of them. The precise arrangement of the rays in respect to one another is identical on the two sides of the fish, but the amount of luminous tissue carried by corresponding rays is not always the same.

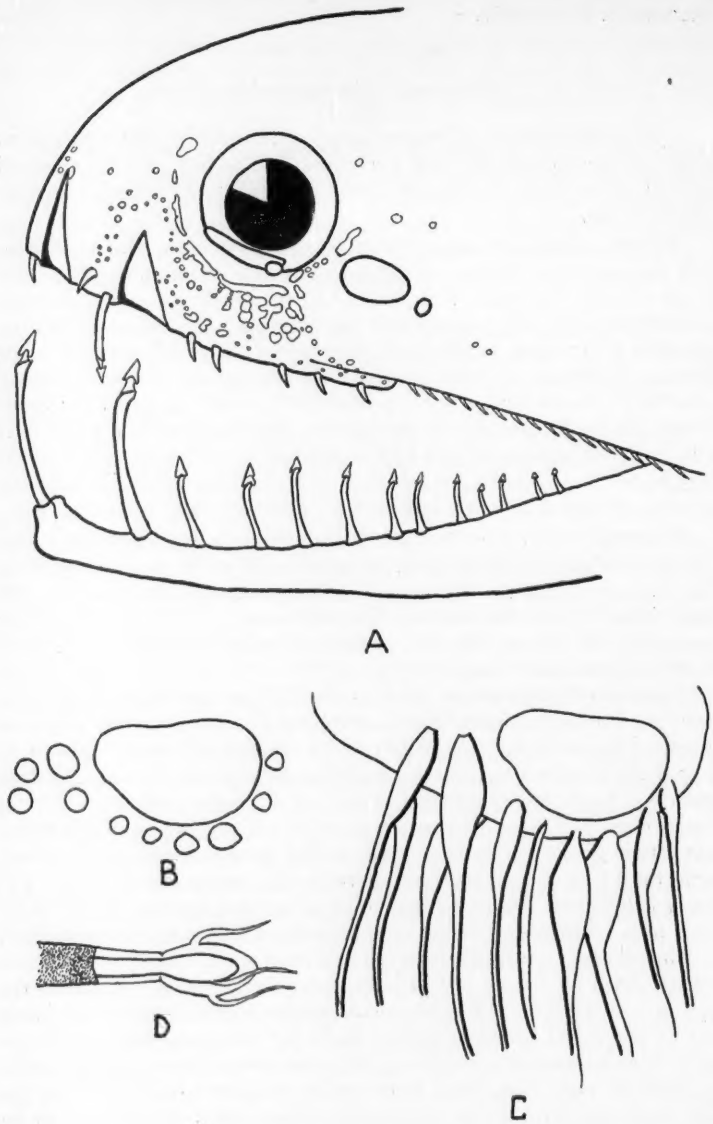


Fig. 7. *Aristostomias photodactylus*, sp. nov. A, head, ×6. B, plan of pectoral fin. C, base of pectoral fin, ×16. D, end of barbel, ×35.

The pelvics have strong, black, basal membranes and are delicately webbed almost to their tips. They do not reach the anal origin. The dorsal and anal are typical of the genus, with deep black membranes covering all except the tips of the rays. The caudal is very small, the lower lobe being considerably longer than the upper.

The suborbital photophore is two-thirds as long as the eye, very narrow, only slightly curved and infringing upon the front and lower border of the orbit. In the fresh specimen this light gleamed brilliant scarlet; the small, round, luminous "Doppelorgan," located in the suborbital's lower, posterior corner, was bright pink and the large, oval, postorbital photophore greenish-yellow. The latter organ is shorter than the suborbital but much broader.

The barbel is one-third as long as the fish, with the stem completely sheathed in dark brown skin. The small, elongate, terminal bulb (0.7 mm in length) is divided into two sections by a deep constriction of the outer envelope slightly above the middle of its length. The proximal portion is scarcely broader than the stem; the distal is definitely swollen, ending in a pointed tip. There are two or three short filaments, as long as the distal portion of the bulb, which arise midway between the constriction and the bulb tip.

The serial photophores are all small, the organs of the A–C series being practically invisible. The most posterior O–V photophores are not in a close-set group, as in *A. scintillans,* though the last two are separated by a smaller space than the others of the series, as in *A. lunifer.* Minute lesser lights are scattered over the entire fish.

A narrow, broken, semicircular strip of luminous tissue half surrounds the eye and suborbital anteriorly and ventrally, spattering out at both ends into several separate luminous dots. Similar dots and dashes of various sizes radiate forward and downward from the crescent, dying out in small speckles at the tip of the snout and along the margin of the upper jaw. In the troughs of specialized skin for the reception of the mandibular fangs, there are, however, only one or two minute photophores, such as are scattered all over the head and body. There is a single, conspicuous luminous dot immediately behind the postorbital light.

Discussion.—This new species is close to *A. lunifer* Regan and Trewavas 1930, showing no conspicuous differences either in proportions or in photophore numbers and arrangement, and having in common with it a luminous crescent in front of and below the eye and suborbital organ. The following characters, however, immediately distinguish *A. photodactylus*: The pectoral fin has 10 rays, not 7 to 8, and all, grouped about a special luminous organ, bear luminous material; the barbel bulb has a central constriction and carries several filaments, instead of being perfectly simple and scarcely differentiated from the stem; and, finally, the luminous crescent is much more elaborate in the present form, being supplemented by luminous spots and speckles on the snout and jaws.

A. lunifer is known from four specimens, 28 to 93 mm in length, from the western Atlantic and the Caribbean Sea.

Ultimostomias, gen. nov.

Form elongate and compressed; snout moderately short; jaws enormous, typically malacosteid; premaxillary teeth relatively long, oblique, the second longest, others about equal; mandible with second and fourth teeth much longer than the rest, otherwise similar to those of the premaxillaries; vomer and palatine toothless; pectorals absent?; pelvics inserted at about the middle of the length, long, 5-rayed, the first ray broad and flat; dorsal and anal set far back, the anal longer than the dorsal and originating considerably in advance of it; a single conspicuous orbital photophore, placed well below and behind the eye; barbel present; serial photophores present, with equal spaces between the organs.

Ultimostomias is unique among malacosteids in having only 5 pelvic rays, not 6, and in having the anal longer than the dorsal and originating well in front of it. The new genus is closest to *Photostomias,* sharing with it the characters of equidistant serial photophores, a moderate postorbital organ, a slender form, and probably, a lack of pectoral fins. It differs from *Photostomias,* however, and resembles *Aristostomias* in having a long barbel, instead of none, and a snout moderately short and convexly curved, not greatly reduced and almost perpendicular at the tip.

8. *Ultimostomias* ***mirabilis,*** sp. nov.

(Fig. 8)

Type.—Department of Tropical Research No. 10,865; Bermuda Oceanographic Expeditions of the New York Zoological Society; Net 215; June 24, 1929; 12 miles south of Nonsuch Island, Bermuda; 900 fathoms; standard length 40 mm.

Measurements and Counts.—Total length 43.7 mm; standard length 40 mm; depth 4 mm (in length 10); mandible 9.1 mm (in length 4.4); eye 1.4 mm (in mandible 6.5); snout 1.1 mm (in mandible 8.3); snout to pelvic 17 mm; pectoral rays 0?; pelvic rays 5; pelvic length 14.3 mm; dorsal rays 22; anal rays 28; postorbital 1.1 mm (in head 9.1); barbel length 417 mm (10.4 times standard length). Serial photophores: lateral series, O–V 11, V–A 22; ventral series, isthmus?, O–V 12, V–A 22, A–C 9.

General Description.—In form this fish resembles the slender species of *Photostomias* more than the other deeper members of the genus, but the comparatively long snout is similar to that of *Aristostomias.*

There are 8 teeth in each half of the premaxillary, the second on each side longest; each maxillary holds 11 or 12 long, oblique, equal teeth; in each mandibular ramus are 17 teeth, the second and fourth twice as long as any of the others, but otherwise similar to those of the premaxillary.

The pectoral region is badly damaged, so that it is possible that the pectoral fins have been torn away; however, there is a small nubbin close behind the lower part of the gill opening on the right side, similar to that found occasionally in *Photostomias,* which indicates that pectorals are normally lacking in this new fish also. The pelvics are inserted well in front of the middle of the length. The 5 rays are all long, almost reaching the anal. The first ray is about twice as broad as the rest, although not at all

thickened, which suggests that the reduction in number of the 6 rays typical of this family has been brought about by the consolidation of the first and second. The dorsal originates above the sixth anal ray. The rays of these vertical fins are fully webbed, and have the bases elevated, but there is no trace of the thick black membranes found in *Malacosteus* and *Photostomias.*

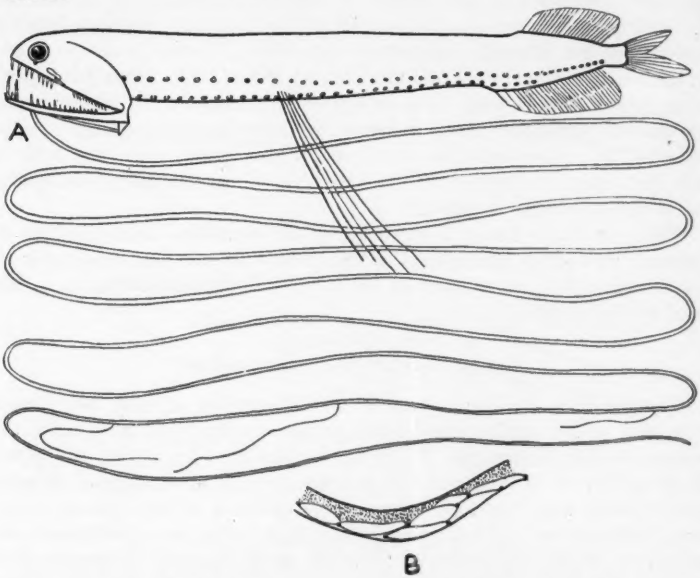


Fig. 8. *Ultimostomias mirabilis,* gen. et sp. nov. A, lateral view, ×2.4. B, portion of barbel stem, greatly enlarged.

The round suborbital is minute, set close beneath the center of the eye, almost infringing upon the orbit. The narrow postorbital, equal to the snout in length, is situated well behind the eye, against the dorsal margin of the jaw. In the fresh specimen this luminous organ was bright silver.

The extremely long barbel, more than 10 times the length of the fish, tapers very gradually, with 3, thread-like branches arising at intervals in the distal portion. Half of the barbel (probably the anterior, although orientation is difficult, owing to twisting) is thinly dotted with round, dark spots; the other half has a series of elongate, white, light organs, singly, side by side or alternating each with a tiny photophore, black with a white cap.

In the new-caught fish the serial photophores, set rather deeply in the black skin, were violet, those of the ventral series having silvery frames. All of the organs have equal spaces between.

Department of Tropical Research, New York Zoological Society, New York City.

Two New Records of Deep Sea Fishes from New England with Description of a New Genus and Species

By Albert Eide Parr

In the collections of the Boston Society of Natural History are two specimens of deep sea fishes which have been obtained at different times from the stomach contents of swordfish (*Xiphias gladius*) caught on the banks at the entrance to the Gulf of Maine. Of these two specimens, which have recently been submitted to the writer for identification, one has not only been found to belong to a new species but may even be described as a representative of an entirely new genus, while the other is only the second of its kind in the museums of the world, at least as far as the published records show.

Both specimens belong in the order of the stomiatoid fishes, one representing a new genus and species of the family Stomiatidae, *sensu stricto*[1], and the other being a member of the family Melanostomiatidae as understood by the writer.[1]

Family Stomiatidae, *sensu stricto*[1]

The previous literature contains the descriptions of only two genera pertaining to the family Stomiatidae, as here understood; these being the genera *Stomias* Cuvier and *Macrostomias* Brauer. Reviewing the genus *Stomias*, Brauer[2] in 1906 was able to point out that the barbels of all nine species known until that time were entirely identical in their general structure, consisting only of a simple, slender stem ending in a small luminous bulb from which three simple, perfectly equal terminal filaments arise together distally (see fig. A). It would thus seem as though this simple barbel with the tri-tentaculate bulb might be regarded as a character of generic rank. Among the species subsequently described, however, *Stomias fusus* Beebe[3] differs in having only two terminal filaments and a swollen, but still simple stem, and the illustration of *Stomias brevibarbatus* Ege[4] shows two *pairs* of minute threads arising from the distal end of the bulb instead of the usual three unpaired filaments, although nothing is said about this feature in the text. It thus appears that a certain amount of variation in the number of terminal filaments may occur also in the genus *Stomias*, but it still holds good of all of the thirteen species now known to science that the stems of the barbels are perfectly simple, without any indication of branches or serially arranged appendages of any kind between the base and the terminal bulb. In view of this fact it seems reasonable to accept the simplicity of the stem of the barbel as a diagnostic character of the genus *Stomias*, and consequently to describe as representative of a new genus, the species now on hand, in which the barbel gives rise to two well developed branches between its base and the terminal bulb.

[1] See Parr: Bull. Bingham Oceanogr. Coll., 7 (2): 15; and Copeia, 1930 (4): 136.
[2] Wiss. Ergeb. Deutsche Tiefsee-Exp. Valdivia, 15 (1), Die Tiefsee-Fische, Systematischer Teil, 1906: 44.
[3] Zoologica, 12 (1): 7, fig. 1 B.
[4] Rep. Danish Oceanogr. Exp. 1908–1910, No. 4, 1918: 23, fig. 11.

The three genera of the family Stomiatidae, *sensu stricto,* may then be differentiated from each other in the following manner:

A. Ventrals inserted in the posterior third of the length of the body.
   I. Barbel with terminal filaments from the distal end of the luminous bulb, but otherwise unbranched .....*Stomias* Cuvier
   II. Barbel with branches from the stem between its base and the main bulb, which also carries terminal filaments .....*Stomioides,* n. gen.

B. Ventrals near the middle of the body. Luminous bulb surrounded by long, thin filaments .....*Macrostomias* Brauer

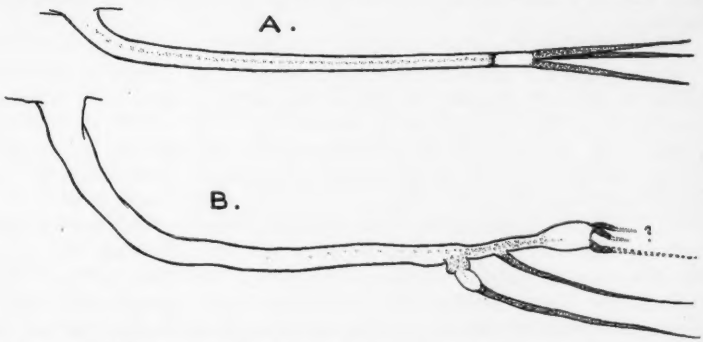


Fig. A. Typical *Stomias* barbel (drawn from a Pacific specimen of *Stomias atriventer* Garman, 127 mm. long, in the Bingham Oceanographic Collection).

Fig. B. Barbel of *Stomioides nicholsi,* n. sp.

Stomioides, new genus

Barbel with branches between its base and the main bulb, and with terminal filaments from the latter. Ventrals in the posterior third of body.

Genotype: *Stomioides nicholsi,* n. sp.

1. *Stomioides* ***nicholsi,*** new species

One specimen taken from stomach of *Xiphias gladius* harpooned 220 miles E S E of Thatcher's Island (S E peak of Browns Bank) above 250 fathoms depth, August 3, 1932. Schooner Barbara, Captain C. A. Turner. Boston Soc. Nat. Hist., No. 2010.

Length without caudal fin, 265 mm. Proportions in per cent of length without caudal fin: Greatest depth of body 8.3. Length of head 8.7. Length of maxillary 8.3. Length of lower jaw 9.8. Length of snout 1.6. Diameter of eye 2.1. Length of longest tooth in premaxillary 1.5. Interorbital width 2.4. Length of barbel to end of bulb 6.5. Snout to ventrals 70. Origin of dorsal fin to base of middle caudal ray 13.7. End of dorsal fin to base of middle caudal rays 5.5. Origin of anal fin to base of middle caudal rays 15.1. End of anal fin to base of middle caudal rays 3.7. Base of dorsal fin 8.3. Base of anal fin 11.1. Depth of caudal peduncle 1.5. Length of P. about 8. Length of V. about 10.

Ventral series of photophores: I–P 13; P–V 47; V–A 11; A–C 17. Lateral series: P–V 46; V–A 12; A–C, 1 only, above anterior end of anal

fin base. 15 branchiostegal photophores. Suborbital photophore minute, situated near vertical from posterior margin of orbit.

Anal rays 23; dorsal 20; pectoral 6; ventral 5; lateral line pores 78–79; branchiostegal rays 15.

Each premaxillary with one small tooth anteriorly followed by one large, decurved fang and 3 smaller fangs far apart. Each limb of the lower jaw with two teeth close together anteriorly followed by six somewhat larger teeth. Vomer with a pair of fixed fangs. Two teeth on each palatine. Each maxillary with a series of fine, sawtooth-like teeth, but without other dentition.

General appearance as in the genus *Stomias*.

Barbel with a comparatively strong, simple branch from its anterior surface immediately beyond the end of the second third of the distance from its base to the distal end of its terminal bulb. This first branch carries a small luminous bulb close to its thickened base and extends beyond this bulb as a relatively strong, simple, tapering filament, the total length of the branch equalling about two-fifths of the length of the main stem of the barbel. A second branch in the form of a simple tapering filament without any bulb originates about midway between the first branch and the main bulb, also from the anterior surface of the barbel. The main, terminal bulb is small, only slightly swollen and carries three appendages from its distal surface, one from its anterior corner and two arranged in a pair at its posterior end. Of these terminal appendages the single anterior one is considerably thicker than the posterior two and has obviously been torn off a short distance from its base. A small, simple, black filament similar to the terminal portions of the two branches was also found detached in the wrappings in which the specimen was received, and the writer feels fairly confident that this must have represented the continuation of the anterior terminal appendage on the main bulb. It does not seem impossible that the posterior pair of appendages may also have been longer than they are now, although the indications of damage on the specimen are not quite so clear on this point. Apart from the loss of the distal part, or parts, of the terminal filaments, the barbel is preserved in a very good condition. To a casual glance the main stem of the barbel would appear to be quite colorless (white), but a closer inspection reveals a few widely scattered, deep-seated dots of black pigmentation on the proximal part above the first branch. Between the first branch and the main bulb this underlying pigment becomes denser, but does not darken the barbel so that it becomes very conspicuous in the preserved specimen; while the first branch beyond its bulb, the entire second branch, and the terminal filaments from the main bulb stand off very conspicuously from the paleness of the stem of the barbel by their dusky black appearance caused by a more superficial pigmentation.

Family MELANOSTOMIATIDAE

2. *Trigonolampa miriceps* Regan and Trewavas[1]

One specimen (Boston Soc. Nat. Hist., No. 1862) taken from the stomach of a swordfish caught on Georges Bank by Captain John Tooth-

[1] Danish "Dana" Exp. 1920–22, Oceanogr. Rept. No. 6, 1930: 55, pl. 1, fig. 2.

aker in September, 1922, or prior to that date. Circumstances indicate it was captured that summer. This specimen is the second of its kind so far known to science, the other having been taken in the eastern Atlantic south of Ireland in 1906 by the Danish research vessel "Thor," towing with 1000 fathoms of wire out, probably corresponding to a vertical depth of about 600 fathoms. Since the Boston specimen is more than twice as long as the type, a brief account of its characters may be in place.

Length without caudal fin 223 mm. Proportions in per cent of the length without caudal fin: Length of head 18. Length of snout 4.4. Interorbital width 5.3. Diameter of eye 3.1. Length of lower jaw 15.5. Length of maxillary 15.5. Diameter of postocular organ 1.6. Greatest depth of body 12.5. Snout to dorsal fin 75. Snout to ventral fins 52.5. Snout to anal fin 81. Base of dorsal fin 15. Base of anal fin 13. Anal to base of middle caudal fin rays 7.1. Dorsal to base of middle caudal fin rays 8.8. Depth of caudal peduncle 3.1. Longest premaxillary tooth 1.7.

Dorsal rays 19; anal 19; ventral 7; pectoral 5; branchiostegal rays 15.

Ventral row of photophores: I–P about 12–13 (by estimate of space, only the posterior 7 being preserved); P–V 23; V–A 22. Lateral row: O–V 24; V–A 23. The three last photophores in the lateral and in the ventral series (section V–A) are situated above the base of anal fin. A–C more than 9, the eighth being situated immediately behind the base of last anal ray. Only 11 photophores on each branchiostegal membrane. A rather large (see measurements) globular postocular organ of the very movable type best known from the genus *Malacosteus* is situated so that its center is directly below the posterior margin of the orbit. A small rounded luminous patch immediately behind the subocular organ and the long triangular patch above and behind the latter, stretching backwards across the top of the cheek as described by Regan and Trewavas, are both present on the left side of the head, while the right cheek has completely lost its skin and luminous organs as well as a part of its musculature through damage to the specimen. Apart from this and the loss of the upper part of the caudal fin and fin base, the specimen is in a quite good condition, however.

Lower jaw with about 15–18 small, decurved, fixed fangs in each limb; 7–8 fixed, decurved teeth in each premaxillary, the first, second, fifth and seventh or eighth somewhat larger than the others; 17–20 teeth in each maxillary, all fixed and decurved, the posterior 10–12 very small and closely spaced in a comb-like series. A pair of depressible fangs on vomer. A long series of about 12–14 fixed decurved teeth on each palatine. Tongue with 3 pairs of teeth on the posterior portion of first basibranchial, 2 pairs on the second and one pair on the third. 14–15 groups of teeth, mostly consisting of 3 each, in the lower limb of the first gill arch; and 5 groups mostly consisting of 5 teeth each in the upper limb. Lower pharyngeals with a series of about 5 teeth each.

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The Genera of Indo-Malayan and African Cyprinodont Fishes Related to *Panchax* and *Nothobranchius*

By George S. Myers

THE present paper is abstracted from part of a more extensive unpublished manuscript on the classification of the genera of African Cyprinodontidae. The study was begun in 1924, under the kindly supervision of Mr. John Treadwell Nichols, to whom I am greatly indebted not only for the loan of material but for his genial tolerance of my first ichthyological efforts.

The classification of the oviparous Cyprinodontidae is one of the most difficult problems facing the ichthyologist. The species are all small and exceedingly alike and they possess no such ready index of relationship as that provided by the gonopodium of the Poeciliidae. The older attempts at generic segregation were based mainly on a few obvious external differences (for example, fin position) which collapse completely as distinctions when large series of species are compared. In 1911 Regan indicated some fundamental differences between *Aplocheilus* and *Panchax,* which were elaborated by Sundara Raj and others. The first attempt to classify the Old World genera related to *Fundulus* on modern lines was Ahl's paper of 1924. The writer had undertaken study of these fishes at about that time and found himself in disagreement with Ahl on several points. In 1931 the writer published a paper (Myers, 1931) in which he subdivided the Fundulinae into four apparently natural tribes. In this system *Fundulus* and its allies in North America and Spain form a natural division (tribe Fundulini) which excludes those African and Neotropical species formerly referred to that genus. On the other hand the Asiatic and African *"Fundulus"* and *Panchax*-like genera, which have a narrow preorbital, vomerine teeth and pseudobranchiae, form one group (tribe Rivulini) with the Neotropical *Rivulus* and its relatives. Many African species of *"Haplochilus"* agree with *Procatopus* in having high-set pectoral fins and are placed in a third division (tribe Aplocheilichthyini), while the Asiatic *Aplocheilus,* with non-protractile premaxillaries, is placed in a fourth tribe (Aplocheilini). *Lamprichthys* is relegated to a separate subfamily. The synopsis now presented revises the genera of Old World Rivulini.

The characters found of most value in delimiting the genera have to do chiefly with mouth structure, particularly the position of the maxillary bone and its relation to the surrounding tissues. The examination of these features in such small fishes must be carried out under a binocular dissecting microscope.

Tribe Rivulini

Premaxillaries protractile. Pectoral fins set low. Preorbital very narrow, less than half eye diameter in width. A small patch of teeth on the head of the vomer and small tuft-like or flattened pseudobranchiae usually present; in a few species one or the other, or both, may be absent.

The genera of this tribe range throughout most of tropical America, Africa and Asia. The Neotropical genera have already been reviewed (Myers, 1927). One described African genus, *Fundulosoma* Ahl (1924: 50), from Togoland, has not been included in the key. I have been unable to obtain a cotype of *F. thierryi* for examination and the tooth structure described as diagnostic is to be seen in many partly dried or shriveled specimens of other genera.

SYNOPSIS OF THE GENERA

1a. Distal end of maxillary for half or more its length free from the external skin of the preorbital and movable forward; jaws produced; profile of snout sharp; snout and head greatly flattened; dorsal fin origin over middle of anal fin base, or farther back.

2a. Maxillary entirely free from the skin of the preorbital region and very freely movable forward; haemal arches of the caudal vertebrae expanded for the posterior extension of the coelom and air-bladder through them, this extension reaching (in different species) at least through the arches of half the caudal vertebrae and sometimes to the next to last vertebra before hypural. 1. *Panchax*

2b. Maxillary distally free from the skin of the preorbital region for only about half its length, much less freely movable forward; coelom and air-bladder not extending into the caudal region and the haemal arches not enlarged. 2. *Epiplatys*

1b. Distal part of maxillary to near its tip closely bound by the skin or in the flesh of the preorbital region and very nearly or quite immovable; dorsal position various; profile of snout less sharp.

3a. Caudal fin closely and finely scaled more than half way to its tip with regular, diverging series of scales, each row set over an inter-radial space; form *Panchax*-like but more robust; dorsal origin behind that of anal. 3. *Pachypanchax*

3b. Caudal with only normal basal squamation, not in straight, diverging series; dorsal position variable; form not *Panchax-like,* the snout usually less flattened and produced.

4a. Depth of head at occiput equal to or less than its greatest width; body elongate, not chubby; preorbital bone at its narrowest point usually 0.25 to 0.33 diameter of eye; dorsal position variable. 4. *Aphyosemion*

4b. Depth of head at occiput greater than its width; body chubby and somewhat compressed; preorbital bone at its narrowest point usually 0.20 eye diameter or less; dorsal origin opposite that of anal or more anterior, both fins usually rather high. 5. *Nothobranchius*

1. *Panchax* Cuvier and Valenciennes

Panchax Cuvier and Valenciennes, Hist. Nat. Poiss., 18, 1846: 380 (genotype *Esox panchax* Hamilton Buchanan, by tautonymy).

This genus is wholly Indo-Malayan in distribution. I have examined many specimens of *P. panchax* (Hamilton Buchanan), *P. lineatus* Cuvier and Valenciennes and *P. blockii* (Arnold). This last species (*Haplochilus panchax* var. *blockii* Arnold, Wochenschr. Aquarien und Terrarienkunde, 8, 1911: 672, fig. 3, type locality Cochin) seems to be identical with the more recently described *Panchax parvus* Sundara Raj. I have not seen the Ceylonese *P. dayi* (Steindachner). Steindachner's *Haplochilus rubropunctatus,* said to be from China, may be a mislabelled African *Epiplatys.*

2. *Epiplatys* Gill

Epiplatys Gill, Proc. Acad. Nat. Sci. Phila., 1862: 136, footnote (genotype *E. sexfasciatus* Gill).

Lycocyprinus Peters, Monatsb. k. Akad. Berlin, 1868: 146 (genotype *Poecilia sexfasciata* Peters, *nec* Gill, = *Haplochilus chaperi* Sauvage).

This well-marked genus is entirely African in distribution. It is apparently absent in East Africa. I have been able to dissect only four species of *Epiplatys, E. sexfasciatus* Gill, *E. chaperi* (Sauvage), *E. fasciolatus* (Günther), and *E. annulatus* (Boulenger), but as these four are probably as diverse anatomically as it is possible to find within the genus, I feel sure that the others will prove to differ very little in the air bladder and haemal arches. Other species of which I have examined specimens are: *E. multifasciatus* (Boulenger)[1], *E. macrostigma* (Boulenger), *E. nigricans* (Boulenger)[1], and *E. singa* (Boulenger)[1]. Others not seen which certainly belong to this genus are: *E. ansorgii* (Boulenger), *E. baudoni* (Pellegrin), *E. bifasciatus* (Steindachner), *E. boulengeri* (Pellegrin), *E. chevalieri* (Pellegrin), *E. grahami* (Boulenger), *E. longiventralis* (Boulenger), *E. marnoi* (Steindachner), *E. normani* (Ahl), *E. nyongensis* (Ahl), *E. ornatus* (Ahl), *E. petersii* (Sauvage), *E. sangmelinensis* (Ahl), *E. senegalensis* (Steindachner), *E. steindachneri* (Svensson), *E. taeniatus* (Pfaff) and *E. zenkeri* (Ahl). Others of the many species described by Ahl under *"Panchax"* may belong here.

3. *Pachypanchax* Myers

Pachypanchax Myers, Amer. Mus. Novit., 592, 1933: 1 (genotype *Haplochilus playfairii* Günther).

The only species which can be placed in this genus with certainty is *P. playfairii* (Günther), from the Seychelles Islands. Aquarists have obtained specimens at Zanzibar. Very probably *Panchax sakaramyi* Holly and *Poecilia omalonota* Duméril, both from Madagascar, belong in *Pachypanchax*.

4. *Aphyosemion* Myers

Aphyosemion Myers, Amer. Mus. Novit., 116, 1924: 2 (genotype *A. castaneum* Myers).

Fundulopanchax Myers, Amer. Mus. Novit., 116, 1924: 4 (as a subgenus; genotype *Fundulus gularis* var. *caerulea* Boulenger).

This genus is a very large one and contains several diverse elements. It was originally described to include especially those species of Boulenger's *"Haplochilus"* with low-set pectoral fins, rounded snout and posterior dorsal, related to *elegans*. With these I included the more elongate species of Boulenger's *"Fundulus,"* related to *gularis*, under the subgenus *Fundulopanchax*, since it seems impossible to draw a line, based on dorsal position, to distinguish the two groups. Ahl (1928: 116), while holding *"Fundulus"* as distinct, has synonymized this genus with *"Panchax"* (=*Panchax*+*Epiplatys*). Holly (1930) still further confuses the issue by including species of *Aplocheilichthys* in *Panchax*.

[1] Types examined.

With the more complete diagnosis now given there is no excuse for the confusion of *Aphyosemion* with either *Panchax* or *Epiplatys*. The structure of the maxillary of *Aphyosemion* is very different. Even on the rather incomplete and vague original description of the genus (particularly the rounded snout) it is possible to recognize well preserved specimens of *Aphyosemion* without microscopic examination. This is well illustrated by the fact that aquarists, who in general know these fishes better than most ichthyologists, immediately accepted the genus and found no difficulty in recognizing its members in their aquaria (see Rachow, 1931). It was, in fact, the differences observed in aquaria that led me to describe the genus. Aquarists have, however, of late used the name *Fundulopanchax* in a generic sense. The only justification for such use is the differing dorsal position of the two groups. I admit that the larger species of *Fundulopanchax*, with heavily undershot lower jaw and long anterior dorsal fin are very different from the delicate little fishes related to *elegans*, but I confess my inability to draw any hard and fast line between the two. When one takes into consideration such a series as *gardneri, multicolor, loennbergii, splendopleuris, liberiense* and *cameronense*, I fail to see how the species may be divided into two genera, one with the dorsal origin above or before that of the anal and the other with the dorsal origin behind that of the anal. It was just this point that made Boulenger's separation of *"Fundulus"* and *"Haplochilus"* seem unnatural. In the case of *gardneri* Boulenger originally described the male as a *"Fundulus"* and the female as a *"Haplochilus"*! In aquaria, specimens of *splendopleuris* and even of *caeruleum* show in their habitus and actions their resemblance to *Aphyosemion* (*sensu stricto*) and their difference from *Epiplatys* and *Panchax*.

The chief difficulty in defining *Aphyosemion* in its present sense is the similarity of certain species of the subgenus *Fundulopanchax* to *Nothobranchius*. It may be found impossible to draw a distinct line, but the material examined falls readily enough into one genus or the other.

Subgenus *Aphyosemion*.—Dorsal fin inserted slightly to considerably behind origin of anal. Dorsal short, rays 8 to 12. Smaller species with a more rounded snout and less projecting lower jaw. Angled notch before eye for reception of rictus well developed. Teeth in each jaw in a relatively narrow band, at all points much narrower than half eye diameter.

The known species of this subgenus range from Liberia, Cameroon and Gaboon over the entire Congo Basin. They do not appear to be found in Tanganyika. I have examined the following species: *A. australe* (Rachow), *A. calliurum calliurum* (Boulenger), *A. cameronense* (Boulenger), *A. castaneum* (Myers)[1], *A. christyi* (Boulenger)[1], *A. elegans* (Boulenger)[1], *A. ferranti* (Boulenger)[1], *A. lujae* (Boulenger)[1] and *A. schoutedeni* (Boulenger)[1]. Species not seen, but which doubtless belong to this group, are: *Aphyosemion calliurum ahli* Myers, *A. exiguum* (Boulenger), A. *liberiense* (Boulenger), *A. meinkeni* Myers, *A. oeseri* (Ahl), *A. pascheni* (Ahl) and *A. vexillifer* (Meinken).

Aphyosemion calliurum ***ahli*** is a new name to replace *Panchax calliurus* var. *caeruleus* Meinken (Das Aquarium, Jan., 1932: 3, pl. 48, fig. 1; no

[1] Types examined.

locality given) preoccupied by *A. caeruleum* (Boulenger) 1915. *Aphyosemion* ***meinkeni*** is a new name to replace *Panchax pictus* Meinken (Blätt. Aquarien und Terrarienkunde, 43, 1932: 56, fig. 3; Tropical West Africa) preoccupied by *Panchax pictum* Cuvier and Valenciennes (=*Betta picta*).

A number of other names proposed by Ahl doubtless refer to fishes of this group, but it is impossible to determine their generic status from his descriptions.

Subgenus *Fundulopanchax*.—Dorsal fin before, over, or slightly behind that of anal. Dorsal fin comparatively longer, rays 10 to 16. Larger species, generally with a slightly more projecting lower jaw and heavier gular region. Angled notch before eye for reception of rictus well developed. Teeth in each jaw in a relatively narrow band, at all places much narrower than half eye diameter.

The distribution of this subgenus is rather restricted, the species ranging from the Gold Coast through Southern Nigeria to South Cameroon. In the Congo drainage they have been taken only in the Sanga Basin (Ja and Sanga Rivers). This area is almost entirely within the West African rain-forest. I have examined the following species: *A. bivittatum bivittatum* (Lönnberg), *A. caeruleum* (Boulenger), *A. gardneri* (Boulenger), *A. gulare* (Boulenger), *A. loennbergi* (Boulenger), *A. multicolor* (Meinken), *A. splendidum* (Pellegrin)[1], and *A. splendopleuris* (Meinken). The following species have not been seen: *A. arnoldi* (Boulenger), *A. batesii* (Boulenger), *A. beauforti* (Ahl), *A. bitaeniatum* (Ahl), *A. bivittatum hollyi* Myers, *A. gustavi* (Ahl), *A. filamentosum* (Meinken), *A. pappenheimi* (Ahl), *A. riggenbachi* (Ahl), *A. rubrostictum* (Ahl), *A. spurrellii* (Boulenger), and *A. zimmeri* (Ahl). Whether *Fundulus palmquistii* Lönnberg and *F. walkeri* Boulenger belong to this genus or to *Nothobranchius* I do not know. Several of the described species seem to be poorly defined.

Aphyosemion bivittatum ***hollyi*** is a new name to replace *Fundulopanchax bivittatus* var. *coerulea* Meinken (Blätt. Aquarien und Terrarienkunde, 41, 1930: 178, fig.; Equatorial West Africa) preoccupied by *A. caeruleum* (Boulenger) 1915.

Subgenus ***Callopanchax,*** new.—Dorsal and anal fin origins rather far forward and opposite. Dorsal very long, with 17 to 19 rays. Larger species, with a projecting lower jaw. Angled notch before eye for reception of rictus rather poorly developed. Teeth in each jaw in a very wide band, wider at the sides of the lower jaw where the band is wider than half the eye diameter.

There is only one species in this subgenus, the type species, *Aphyosemion sjoestedti* (Lönnberg). It ranges from Sierra Leone to South Cameroon, in the coastal region.

5. *Nothobranchius* Peters

Nothobranchius Peters, Monatsb. Akad. Wiss. Berlin, 1868: 145 (genotype *Cyprinodon orthonotus* Peters).

Adiniops Myers, Amer. Mus. Novit., 116, 1924: 6 (genotype *Fundulus guentheri* Pfeffer).

[1] Types examined.

This genus ranges from Somaliland and Mozambique to the Central African Lakes and Northern Nigeria. It is not found in the Congo Basin or the West African rain-forest.

Recent study has convinced me that Ahl was perfectly correct in referring *Fundulus neumanni, F. guentheri,* and related forms (=my *Adiniops*) to *Nothobranchius. Fundulus kuhntae* Ahl and *Adiniops troemneri* Myers, both from Beira, appear to be identical with *N. orthonotus.* Peters' types of *orthonotus,* one of which I have examined, were in poor condition, and the lips are flabby and stretched. This makes the specimen I have examined (just as in Peters' figure) seem to have a great lateral gape. I find that the lips, when placed in their original position, are like those of *guentheri. N. orthonotus* has, however, longer jaws than any other *Nothobranchius,* but I cannot separate it generically on this character alone.

I have examined specimens of the following species: *N. orthonotus* (Peters)[1], *N. kiyawensis* Ahl, *N. guentheri* (Pfeffer), *N. neumanni* (Hilgendorf)[1] and *N. rachovii* Ahl. Other species which appear to belong to this genus are: *N. microlepis* (Vinciguerra), *N. patrizii* (Vinciguerra), *N. taenopygus* (Hilgendorf), and *N. vosseleri* Ahl. *Fundulus palmquistii* and *walkeri* may, as mentioned above, belong here. Further, it seems probable that *Fundulus melanospilus* Pfeffer, from the Seychelles Islands, and *F. gambiensis* Svensson, from the Gambia, belong to *Nothobranchius.*

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[1] Types examined.

A Malformed Tail and Spine of the Sting-Ray *Dasyatis hastata*

By E. W. Gudger

Introduction

DURING eleven years of fishing at the Laboratory of the United States Bureau of Fisheries at Beaufort, North Carolina, and four others at Key West and among the keys west to the Dry Tortugas, Florida, where I worked at the Marine Biological Laboratory of the Carnegie Institute of Washington, my notes record several cases of sting-rays with defective tail structures. Thus at Beaufort, in 1910, I got a butterfly ray, *Pteroplatea maclura,* with the tail gone—cut off clean at its point of origin between the pelvic fins. This fish hardly belongs in this study, since I have never found one with a sting, some authors and many fishermen to the contrary notwithstanding. Stings are alleged to be found only in old and large specimens, very few of which I have examined.

However, there are in my notes seven records of "stingarees," sting-rays, similarly deficient either in tails or spines or both. Thus at Beaufort, in 1911, I obtained a male *Dasyatis say,* 12 inches wide, with its tail gone—taken off close to the body. Another male, 18.5 inches wide, had only the stump of a tail about an inch shorter than the claspers. A much younger fish, only 6.75 inches wide (probably not a week old since birth), had the extreme tip of the tail gone. In Florida at Tortugas in 1912, a female *Dasyatis hastata* 3 feet, 1 inch wide, and 5 feet, 7 inches from tip to tip, was harpooned. The tail was without spines but fresh scars showed where they had recently been torn out—the hinder one more recently. Again in June, 1913, a specimen taken at Woman Key lacked a spine. My notes say, "No spine—torn out." In the same month, at Key West, my harpooner got a female spotted sting-ray, *Aetobatus narinari,* 5 feet, 2 inches wide, and 9 feet, 9 inches long "over all." This had on the base of the tail three large spines about 5.5 inches long each, while in front of these was a short broken spine about 2 inches long, hanging by a piece of torn membrane.

The Malformed Tail and Spine of Dasyatis hastata

The most unusual and interesting specimen of a hurt tail is that now to be figured and described. It is from a female taken at the Marquesas, about 20 miles west of Key West, in 1912. My brief notes say, "Its tail had been cut off just behind the point of the sting and had been broken in two just posterior to the insertion of the spine. Here the parts had grown together again, but as the ends were not in apposition, in healing a very bad repair job had resulted." The ray was 4 feet, 6 inches wide, and 5 feet, 9.5 inches long to the end of the abbreviated tail.

This tail was cut off, cured in 10 per cent formalin and then dried. Viewed from above in Fig. 1, three things are readily noted: (1), the break in the tail under the basal third of the spine, (2) the cut off and healed tip of the tail beyond the point of the spine, and (3) the curious fact that the

spine seems to have had a bad hurt, about two-thirds of the way back, from which it never fully recovered. These three disturbances and their results are also seen in lateral view in Fig. 2. They will now be described seriatim.

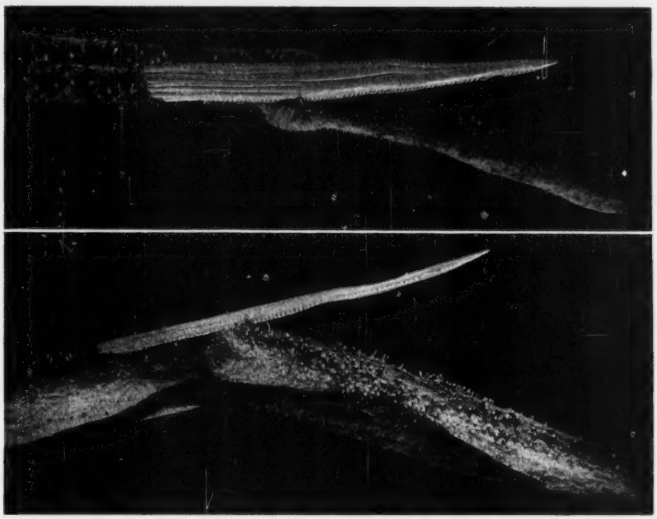


Fig. 1. The malformed tail and spine of *Dasyatis hastata* seen from above. At the break, the hinder half has been shoved forward on the left side of the forward half. The spine has also been hurt toward the tip.

Fig. 2. The malformed tail and spine of *Dasyatis hastata* seen in lateral view. Note the break in the fin on the ventral side. The forward end of the hinder part of this fin has grown fast to the upper lateral part of the tissues covering the tail anterior to the break.

The Stump Tail.—It is clear that the tail was bitten or cut off. There was no regeneration of the tail as in lizards—indeed it is not known that the tails of sting-rays ever regenerate. The stump has, however, completely healed over and on the scar are found five large starry-based scales.

The Break.—The fracture and resulting dislocation in the tail were about in the middle of the stump. The break seems to have been made from the right side, for the displacement of the anterior end of that part of the tail behind the break is to the left, and as the figures show, the posterior part has slipped forward to become fused on the left side with that part of the tail anterior to the break. This may be seen in both Figs. 1 and 2. The right side of the healed break shows far less change than the left. There is a knuckle-like enlargement at the point of displacement where the section of the tail behind the break bends sharply downward (Fig. 2) and slightly to the left. The skin covering this "knuckle" is in color, texture, and prickles like that found elsewhere on the right side of the tail. However, about 0.5 inch behind the knuckle is a "thread-line"

scar, such as is left from a surgical operation where the edges of the wound are held together by little metal clips. This begins on the ventral surface at about the point where the break originated, runs backward and then obliquely upward and backward to be lost under the bases of the large spinose scales covering the upper third of the right side of the tail. This small scar shows a very perfect healing of the break on this side.

As seen in Figs. 1 and 2, the broken ends are not only not in apposition, but the posterior end has been displaced and pushed forward (anteriorly) on the left by about 0.4 inch. Ufortunately I did not dry the tail with the fin on the lower side flattened out. This fin has become twisted to the left and then curled upward, and so obscures the break on the left side. The fin itself was torn in two at the break and the hinder part carried upward and forward on the left side as the hinder section of the tail was telescoped forward. The anterior end of the posterior section of the tail has been completely healed over by the lateral tissue material of the tail. The hinder end of the anterior section on the left side has healed in such a way that the dark tissue on the top and upper lateral third of the fin has fused with the dark ventral fin to form a continuous sheet of dark tissue as Fig. 2 shows. It should be noted here that the bottom part of this broken tail has been twisted to the left, throwing it considerably out of line with the ventral ridge on the anterior section.

Two other small abnormalities must be pointed out on the left dorsal surface of the anterior end of the hinder section of the tail. Due to the downward depression of the hinder part of the tail, at the point where the spine stands clear of the tail, there is on the left side an almost vertical row of four scales with pointed tips and stellate bases. The topmost one of these leans to the right and seems almost to help tie down the spine. This is very plain in Fig. 1. Counting backward four teeth on the spine, there is on the left side of the tail a scale whose long prominence has been turned outward and downward until it is prostrate on the substance of the tail. This shows in both figures. Under the spine at the point of irregularity in its structure, on the dorsal edge of the tail, there are several spinose scales with tips bent backward and outward. These bendings must have taken place when tail and scales were young and soft, and at the time of or before the break in the tail, with the resulting downward bend which left the spine clear.

The Spine.—This (117 mm long) has been cleaned off carefully that the remarkable abnormality in it may be clearly seen. In lateral, but more distinctly in dorsal view, it is clear that the hinder two-fifths is very much smaller proportionally than the anterior three-fifths. At the point of junction of these sections, the tip section suddenly decreases in width, whereas in a normal spine the decrease in width is uniform from base to tip. Furthermore, at this point the spine is markedly bent to the left. Also at this point of junction, on the dorsal surface of the spine and covering a space of three-eights of an inch, are a number of minute transverse wavy markings in the bony structure. These unfortunately do not show in the figure, but Fig. 1 does show that on both sides the retrorse barbs of the spine are noticeably crowded at this point.

The ventral surface of the spine shows less disturbance than the dorsal. The tip of the spine is markedly bent to the left, the disturbance being located almost entirely in the right half of the bony material—reflecting the conditions seen from above. At this point the spine is abruptly narrowed and the lateral barbs are crowded together as already noted.

What Caused These Abnormalities?

Various accidents might cause some of the defects listed herein, but there is but one capable of producing all of them—the bite of a shark. As early as 1907, I proved by dissection of a hammerhead-shark[1] that its much-prized food consists of its cousins the sting-rays. Its stomach contained the skeleton of a sting-ray, and from its jaws and neighboring parts I got 54 "stings" or spines. Then in 1932 I presented evidence[2] that at least three others of our common sharks prey on rays, sting-rays especially, as was evidenced by the stings embedded in their jaws—twelve in the jaws of a black-tipped shark (*Carcharhinus limbatus*). Furthermore, it seems to be well known to fishermen everywhere that sting-ray bait is the best for taking sharks. At Key West and at Tortugas, I always used it when possible, since sharks which scorned other baits would almost surely succumb to it.

Now it is understandable that sharks could cut off the ends of the tails of rays, and that ray stings driven home in their dense hides might be broken off or torn out by the struggles of ray and shark, but how about those rays which had their tails cut off short? From direct observation no answer can be given. However, it has been noticed by myself and others that when rays are menaced by men they raise both heads and tails above the level of the body (the dorsal surface of the body being then in the shape of a saddle). This is apparently the fighting attitude of the sting-ray. I have had a ray in this fighting position lash out at me and drive its spine so deeply into the side of a boat, that the fish was freed only by breaking the spine. When the tail is thus lifted above the pelvic fins, a shark might dash in and bite it off, leaving a short stump. Again it may be possible that the shark habitually attacks the ray at the hinder end, possibly realizing in its dull-brained way that it is here that its enemy can inflict damage. Many observers have seen sharks chasing rays, but so far as I know no one has recorded the actual method of attack.

An explanation for the deformed sting-ray tail described is not easy. It seems entirely reasonable to conclude that the tip was lost by the bite of a shark. But an explanation is more difficult for the fracture, and even greater for the malformed spine. My judgment is that both hurts were inflicted at the same time and that the ray got away after a severe mauling with the loss of the tip of the tail only. Possibly due to the resistance of the spine, the tail under it was not bitten in two but was broken and the tissues ruptured on the left side. Contraction of the muscles then caused the hinder section to slip forward on the left side of the stump. The explanation of the malformed spine offers more difficulties and would seem

[1] Gudger, E. W. A note on the hammer-head shark (*Sphyrna zygaena*) and its food. *Science*, (n. s.) 25, 1907: 1005–1006.
[2] Gudger, E. W. Cannibalism among the sharks and rays. *Scientific Monthly*, 34, 1932: 403–419, 14 figs.

to fix the date of injury at an early period in the life of the ray. Just here let the reader recall that, of the tailless rays reported above, most were small specimens.

These rays are viviparous, and up to the time of parturition the stings of the young rays in the uterus are only fairly hard—otherwise they would do hurt to the mother. My notes record two spawnings, when the young came forth tail foremost, with barbs on the spines pointing backward. In 1911 at Beaufort the seine one day brought in a young ray 6.75 inches wide and 12 inches long over all, probably not over a week old. When picked up it struck at me viciously and the point of its spine barely pierced the skin of my thumb. This sting, while fairly hard, could not have penetrated the tough covering of a shark.

A full-grown sting, when torn from the tail of a ray, will be replaced by another. A *Dasyatis say* 35 inches wide and 60 inches long over all, had a single spine only 0.5 inch long. Another, 25.5 inches wide, had a large spine in front and a smaller behind—the reverse of the normal condition. The spines of intra-uterine specimens, and even of newly born young, are pink in color, soft at the base and easily cut with a knife.

Such I judge was the condition of the spine under consideration. The hurt from the bite of the shark constricted the young spine in what was then the middle and cut off the blood supply from the already hardening tip. However, the basal section continued to grow and harden progressively backward from the root. These spines grow, elongate, and widen at the base so long as the ray lives—hence the longer the spine, the older the ray and *vice versa*.

Historical Notes

In the literature of the teratology of fishes, so far as I can find, there is but one account of rays with deformed tails. Ford[3] had two specimens of *Raja microcellata* with defective tails. Each of these skates showed a crumpling and twisting of the vertebral column in the hinder part of the body and in the tail, as Ford's figures depict. He offers no explanation as to how these anomalies arose. For a shark Grosser and Prizbram[4] have described a foetal *Acanthias vulgaris* with an undeveloped tail. Second dorsal and caudal fins were lacking; the tail was rolled toward the left and twisted at the tip into a hook. None of these cases is comparable to my specimen (where there has been a definite injury), and it does not seem necessary to do more than merely note them here.

Among teleostean fishes there are numbers of records of sigmoid sinuosities of the vertebral column in either lateral or horizontal planes in the tail region and in the whole body. I have a number of such specimens. But other than my specimen, Ford's two rays, and Grosser and Prizbram's spiny dogfish, there are no caudal deformities recorded for elasmobranch fishes in the literature known to me.

American Museum of Natural History, New York City.

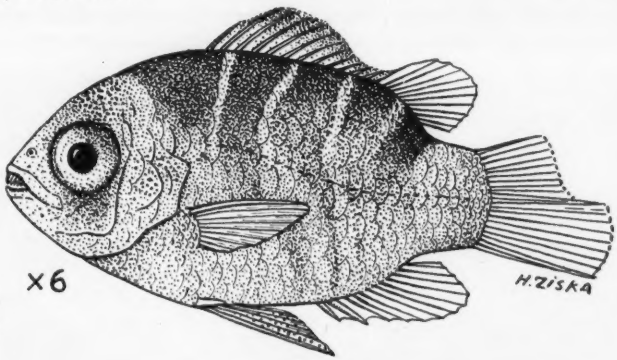
[3] Ford, E. Some abnormal fishes received at the Plymouth Laboratory. 6.—Abnormal rays. *Jour. Marine Biol. Assoc. U. K.* [for 1930–31], 1930, (n. s.) 17, 59–60, text-figs. 5 and 6.

[4] Grosser, O., and Prizbram, H. Eine Missbildungen beim Dornhai (*Acanthias vulgaris Risso*). Archiv Entwick.-Mech. Organismen, 22, 1906: 21–37, pl., 3 text-figs.

New Locality Records of *Abudefduf analogus* Including one from the United States

By C. M. Breder, Jr.

ABUDEFDUF analogus (Gill), originally described from Colon (Aspinwall), Panama, has been known only from that region except for two records; that of Metzelaar[1] from "Bonaire and the playa of Aruba" (*A. concolor,* not of Gill), and that of Nichols[2] from Condado Rocks, Puerto Rico.



Juvenile *Abudefduf analogus* (Gill)
The smallest known specimen (12 mm standard length). Collected by J. T. Nichols at Condado Rocks, Puerto Rico.

On January 24, 1933, a number were seen in a few inter-connecting tide pools near the mouth of Grassy Creek on South Andros Island, Bahamas. A single specimen of 50 mm standard length was taken[3]. The others were close to this size.

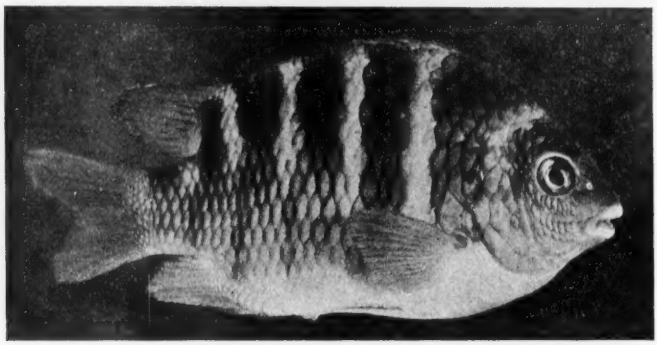
Mr. H. Knowles, collecting living material near Key West, Florida, in June, 1933, reported finding large numbers at Sand Key close to shore at night. One of these, brought to the New York Aquarium, is illustrated in the accompanying photograph and at this writing is still living.

The Puerto Rico specimen, A.M.N.H. 4944, and the Andros specimen, A.M.N.H. 12341, as well as the photograph of the Sand Key specimen, were kindly compared with the Panama material in the National Museum by Dr. S. F. Hildebrand. He found only the following unimportant differences. "Black or dark brown spots were noticed on the teeth of your specimen (A.M.N.H. 12341). The Panama specimens may have had them and faded in preservative" and "Your smaller specimen (A.M.N.H. 4944, July 10, 1914) is rather deeper than those from Panama with which I compared it. The photograph of the Aquarium fish, however, is quite in line in this respect with the Panama material." As the small fish is only 12 mm in

[1] Metzelaar, J., 1919. Over tropisch Atlantische Visschen: 99. Amsterdam (A. H. Krupt).
[2] Nichols, J. T., 1930. *Proc. N. Y. Acad. Sci.,* 10 (3): 309.
[3] Taken on the second Bacon-Andros Expedition. For details of trip, see Breder, C. M. Jr., 1933. *Bull. N. Y. Zool. Soc.,* 36 (3): 54–65.

standard length its depth of 2.0, as compared with 1.8 to 1.65 in the Panama fishes ranging from 27 to 190 mm[4], is not surprising.

The life colors of both the Andros and Sand Key material are essentially of two shades of brown. The dark bars are a Vandyke brown lying on a ground color of tan that presents, however, no suggestion of yellow. The species is recognizable at sight in the field and cannot be easily mistaken for any other West Indian fish, or readily overlooked. Those seen on Andros Island were in the company of more numerous *Abudefduf marginatus* (Bloch) against the brilliance of which they made a decided contrast. As viewed from above, aside from its color differences *A. analogus* may be distinguished by its much stouter appearance in fishes of equal size. Dr. William Beebe in a personal communication states that he saw



Abudefduf analogus (Gill)
A specimen about 120 mm. long, now living at the New York Aquarium. Collected at Sand Key, Florida. The first United States record. New York Aquarium Photograph, by S. C. Dunton.

specimens recognized as this species at Union Island, Grenadines, Antigua and Barbuda in 1932, and at Bimini, Bahamas, in 1933. They ranged from two to five inches in length and were common at these localities. Some were collected, one of which was seen by the writer. Although this fish was much lighter than either the Andros or Sand Key material it was otherwise similar. Dr. Beebe mentioned that all his material is uniform in this respect.

The remarkable feature of these records is, of course, that they have not hitherto been reported from Florida and the nearby parts of the West Indies. Mr. Knowles informs me that he could only find them at night, when, seemingly stupefied by his light, they could be readily caught. If they are decidedly nocturnal, as this would suggest, such an explanation might account for the lack of records. Those seen on Andros, however, were in broad and brilliant daylight, and disported themselves much like their congener, *A. marginatus*. Dr. Beebe's observations were likewise made in daylight. Dr. Hildebrand for a number of years was Director of the Key West Laboratory of the U. S. Bureau of Fisheries and during that period did not find the species. Further, Mr. Knowles stated that he

[4] Meek, S. E., and Hildebrand, S. F., 1925. Field Mus. Nat. Hist., (Zool. Ser.) 15 (2): 103.

found some in the immediate environs of Key West Harbor, although they were not as common as at Sand Key. He reported them from along the beach of a marl "island" thrown up at the mouth of the harbor by dredging operations. The writer, also familiar with the general Key West region and having spent the summer of 1929 at the Tortugas Laboratory of the Carnegie Institution, failed to find any. Also on a prior trip to Andros Island in 1932 none was found. Parr[5], cruising the Bahamas in 1927 did not record the species, nor did Beebe and Tee-Van[6] in their intensive study of Haitian fishes the same year. As all the students mentioned have done extensive field work in the West Indies, it is the more remarkable that but two records foreign to Panama should have appeared down to 1930, and then these other locality records be turned up within a period of two years (1932 and 1933) by three independent collectors, the Sand Key record, at least, being in a very well known area.

Two little known species, *Abudefduf taurus* (Müller and Troschel) and *A.* (*Centrachromis*) *rudis* (Poey), are conceivably poorly described *analogus*. If such is the case, there are then additional records from Barbados[7], Tortugas[8], Cuba[9] and Curaçao[10], with *A. taurus* standing on a priority basis. There is also a West African record of *A. analogus*.[11]

NEW YORK AQUARIUM, NEW YORK CITY.

A New Snake from Panamá[1]

By E. R. DUNN

AMONG the snakes collected by the activities of Dr. H. C. Clark in Panamá in the first quarter of 1933 there is a single specimen of a *Sibynomorphus* which appears undescribed. I am indebted to the authorities of the Museum of Comparative Zoology for permission to examine the collection and to describe the specimen.

I take pleasure in naming the snake in honor of John Treadwell Nichols, who, by founding COPEIA, has done so much to advance the study of cold-blooded vertebrates.

Sibynomorphus **nicholsi**, sp. nov.

Type.—To be deposited in the M. C. Z. Collected first quarter of 1933, through the efforts of Dr. H. C. Clark.

Type locality.—Mid-basin of Chagres River and mouth of Pequeni River, Panamá.

Range.—Known only from type locality.

Diagnosis.—A *Sibynomorphus* with 15 scale rows; middorsal row greatly enlarged; two lower labials in contact behind mental; 9 upper labials, fourth and fifth entering orbit; a small preocular below the loreal

[5] Parr, A. E., 1930. *Bull. Bingham Oceanographic Coll.*, 3 (4).
[6] Beebe, W., and Tee-Van, J., 1928. *Zoologica*, 10 (1).
[7] *Glyphidodon taurus* Müller and Troschel in Schomburgk, *Hist. Barbados*, 1848: 674. Barbados.
[8] *Abudefduf taurus* Jordan and Thompson, 1905. *Bull.* U. S. Bur. Fish., 24: 245. *G. rudis*= *A. taurus*, Tortugas.
[9] *Glyphidodon rudis* Poey, 1861. *Memorias*, 191. Cuba.
[10] Metzelaar, *l. c.*: 101.
[11] Monod, T. 1927. *Faune des Colonies Francaises*, 1(6): 695.
[1] Contribution from the Department of Biology, Haverford College, No. 21.

on the left side, fused with loreal on the right; light tan with large black lateral spots.

Description.—15 scale rows; middorsal row greatly enlarged; 9 upper labials, third and fourth entering eye; a small preocular below loreal on the left side, fused with loreal on the right; 2 postoculars; temporals 2–3 on left side, 1–2 on right; frontal and parietals broader than long; 13 lower labials on left side, 11 on right; two of each side in contact behind mental; five lower labials in contact with anterior geneial; three pairs of geneials, all broader than long, the second markedly so; first ventral partly divided; ventrals?; caudals? (head and neck only); 3 teeth on pterygoid; head much broader than neck; neck compressed laterally; tan above, whitish below; much black marking above on head, most of the scales being outlined with black; a broad black inverted "U" crossing frontal supraoculars and parietals and extending onto nape; an elongate black mark on middle of nape; a dark mark on each side below angle of jaw; large oval black spots on sides from middorsal row to scale row 2, paired or alternate; some smaller spots on sides between them and many scales with black lines; small spots cover two scales of scale row 1, and the tips of the adjacent two ventrals; two irregular rows of gray dots on ventrals.

Remarks.—This species is certainly nothing that has yet been described from Panamá, Costa Rica, or Colombia. Those species of *Dipsas* and *Sibynomorphus* which have two lower labials in contact behind mental all have a preocular above the loreal, and a very different coloration. The nearest approach in color seems to be *andiana,* which has one lower labial pair in contact behind mental and whose locality is quite remote. Colombia is known to harbor the following species with two lower labials in contact: *triseriata, pratti,* and *nigriceps,* and while the scutellation of these is not remote, the coloration is very different. In general in this group the coloration is much more constant than the scutellation of the head.

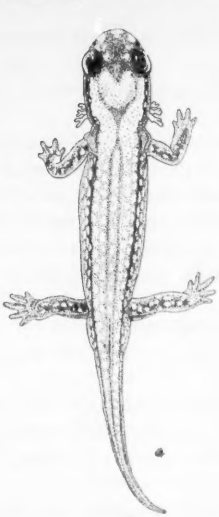
Department of Biology, Haverford College, Haverford, Pennsylvania.

The Nests and Young of the Allegheny Salamander *Desmognathus fuscus ochrophaeus* (Cope)

By Sherman C. Bishop and Hugh P. Chrisp

THE Allegheny salamander is widely distributed and common in many parts of its range but very little has been published concerning its habits and development. Dunn in 1926 was able to summarize in a few lines practically all that had been made known and since the publication of his report very little has been added.

The eggs of this species were reported by one of us (Bishop, 1925: 11) from Troy, Bradford County, Pa. They were found in a shallow excavation beneath a log on a springy hillside August 2, 1924, while on a collecting trip with A. H. Wright. The fourteen eggs were disposed in a mass and attended by a female. Individual eggs were small as was the female found with them. Brief field notes made at the time were as follows: "The eggs



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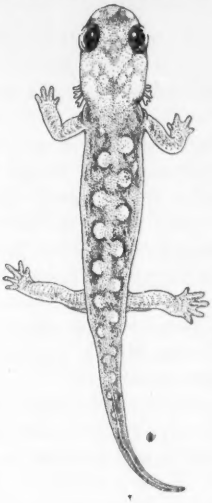

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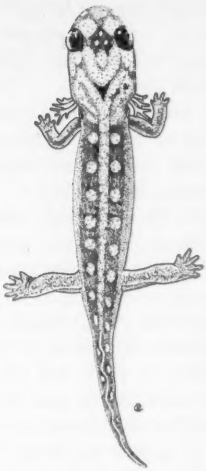

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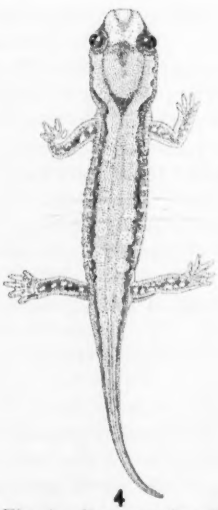

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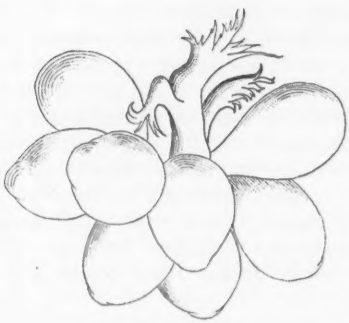

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Fig. 1.—*Desmognathus fuscus ochrophaeus* Cope. Recently hatched larva from Tufa Glen, Rochester, N. Y., March 12, 1933. ×4.2.

Fig. 2.—*Desmognathus fuscus carolinensis* Dunn. Larva from Mt. Mitchill, N. Carolina. October 21, 1923. ×4.2.

Fig. 3.—*Desmognathus fuscus fuscus* Raf. Larva from Conneaute Lake, Pa. Aug. 25, 1925. Often the paired spots form a zig-zag line much as in *D. f. carolinensis*. ×4.2.

Fig. 4.—*Desmognathus fuscus ochrophaeus* Cope. Young just transformed. ×4.2. At transformation, the snout is conspicuously light colored.

Fig. 5.—Empty egg capsules of *D. f. ochrophaeus* Cope.

in the cluster are not brought together at a common focus, as is frequently the case with the eggs of *D. fuscus fuscus,* but several adjacent eggs are united by extensions of the outer envelopes which are more or less pear-shaped."

The eggs were not carried through and for a time some doubt was entertained as to their proper identity. On March 12, 1933, fourteen recently hatched larvae were found in a little cavity beneath the corner of a large flat stone by the side of a small spring, in Tufa Glen near Rochester, New York. Eleven of the young were grouped in a compact mass and three additional larvae and some empty egg capsules were clinging to the lower surface of the stone where it covered the nest. Three adults were beneath the same stone but not at the nest. The soil on which the stone rested was sandy with the addition of considerable vegetable debris; it was thoroughly wet from the trickle of the spring above.

On March 17 we searched the springy hill-side of Corbett's Glen near Rochester and on this date Mr. Richard Hart rolled over a stone partially imbedded in the sandy hillside and exposed another group of young, five of which were collected.

The following day, March 18, a nest containing 14 young was found in a small cavity on the lower side of a rotting log which lay in the saturated soil of a springy slope. Essentially the same type of nest site was chosen in each instance and the eggs were so placed that they received abundant moisture from the water that seeped through the soil beneath.

In the case of the first lot discovered, little significance was attached to the finding of three larvae and empty egg envelopes clinging to the lower surface of the stone but with the recovery of the egg envelopes and young in the cavity of the log, it was evident that the mass had been attached. The large amount of yolk retained by the larvae and the perfect condition of the envelopes, indicated recent hatching.

Unlike the eggs of *Desmognathus fuscus fuscus,* the envelopes of *D. f. ochrophaeus* are not usually drawn together at a common focus but are attached by short extensions of the outer layer to a common stalk, like a bunch of grapes. In this respect they resemble some of the egg masses of *D. f. carolinensis* mentioned by Pope (1924: 4). The empty envelopes were definitely elongated and several had a bulbous protuberance at the free end.

The newly hatched larvae are easily distinguished from those of the dusky salamander and from *D. f. carolinensis.* The general ground color of the sides, the legs and the venter is dull white; that of the back dull yellow tinged with pinkish. The snout above is mottled with pigmented areas and small light spots. From the eyes a median light area is continued backward, abruptly widening behind the eyes to nearly the full width of the head. Just above the gills it contracts and continues along the midline of the trunk as a broad band with nearly straight edges. The dorsal light band lacks the conspicuous dark-bordered light spots so characteristic of *D. fuscus fuscus, D. f. carolinensis* and *D. phoca.* The band is, however, flecked with scattered chromatophores slightly concentrated to form a Y-shaped mark on the head between the gills, and an irregular spot between and in front of the eyes. The dorsal band is limited on each side by a

darker band which originates on the snout in front of the eye, passes through and below the eye and continues on the side of the head and along the sides of the trunk and tail. The lateral band is darkest along its upper margin where the chromatophores are strongly concentrated in a rather narrow strip next to the light median band. The lower sides are mottled with pigment-free areas of irregular shape and size. The ventral surface of the head, tail and legs is dull white with only a few scattered chromatophores along the margin of the lower jaw and on the tail near its tip. The belly is bright yellow, colored by the yolk. The average length of ten specimens is 17.85 mm.

The length of the period the gills are retained is apparently determined largely by the amount of moisture present and, to some extent, by the temperature. Larvae taken March 12 had well developed but short gills free from pigment. On March 16 the gills on some individuals had shortened to half their length and remained in this condition through March 20. On March 24 all but one of ten specimens kept alive had reduced the gills about one half. March 28, nine of the ten specimens still retained very short gill rudiments and one had lost the gills entirely. On April 1 all but one had lost the gills, the single individual retaining rudiments until April 7. This lot of specimens was kept among saturated leaves in a glass jar under cold running water.

Larvae collected March 18 were kept among damp leaves at room temperature of 68 to 70° F. On March 24, nine of the ten specimens kept alive had lost the gills entirely and had undergone a conspicuous color change. The single specimen which retained the gills a few days longer also kept its larval pattern. It is evident, therefore, that the gills may be lost in a few days after hatching or retained for several weeks.

The average length at transformation is 18 mm. The superficial black chromatophores on the snout which give a mottled appearance to the larva largely disappear at transformation, leaving the whole fore part of the head conspicuously light. The mottling of the sides is also largely lost in the generally darker color of the sides below the dorsal band. In a few individuals there is a very slight development of large, round, light spots within the dorsal band.

Since eggs had been found in August and recently hatched larvae in March, we were led to assume that these dates might approximately mark the limits of the egg-laying season plus the period of incubation.

After the foregoing paragraphs had been written we received from Mr. Jay A. Weber of Leonia, N.J., an interesting account of his independent and earlier discovery of the recently hatched young and with his permission the following notes are added.

On September 26, 1932, Mr. Weber found a colony of these salamanders among layers of shale in a drying spring draining into Woodcock Creek in northwestern Pennsylvania. Many sets of eggs were found attached to the under sides of flat rocks in the spring bed. Most of the eggs were attached at one central point and their stalks twisted around one another. The form of the eggs was distinctly elliptical as though shaped by their close attachment and pressure of the embryo. The elliptical shape was retained, however, by the egg capsule after hatching. One clutch

of eggs was laid in sets of three pairs and six singly attached, twelve in all. In another clutch six eggs were attached at a central point with their stalks twisted into a single rope-like strand and the balance attached singly. One mass of twelve eggs was found. When deposited singly, the eggs were almost spherical.

Mr. Weber's observations on the shape of the egg-envelopes, the disposition of the eggs and the number are in close agreement with ours. The discovery of the hatching young in September and again in March raises the question whether we are dealing with a form having an extended breeding season or with one which under slightly different conditions has breeding seasons at distinct periods of the year. The fact that young were found hatching in considerable numbers both in September and March might be taken to indicate that the latter conjecture is the correct one; but the problem is further complicated by the discovery that a few females taken with the newly hatched larvae had large and well developed eggs in the ovaries. On May 12,1933, a single female among several collected at Glen Edith, West Webster, N. Y., by Arlene Thurston and Helen Snearing, was found to have the cap of a spermatophore held in the vent. The mass was small and compact and packed with active sperm.

Summary

1. The larva of *Desmognathus f. ochrophaeus* is quite distinct from that of other species of the genus and easily recognized because of the absence of paired spots within the dorsal light band.
2. The larvae transform at a length of about 18 mm. without entering water. If placed in water they attempt to crawl out.
3. The gills may be retained for several weeks or lost in a few days, depending on the amount of moisture present and possibly, to some extent, on temperature.
4. The freshly laid eggs have been found in August and recently hatched larvae in September and March.
5. Twelve to fourteen eggs have been found to be deposited by a single female and they may be attached singly, in pairs, or in clusters containing as many as fourteen, to some covering object.
6. Fertilization is apparently accomplished by means of spermatophores, a sperm mass having been found in the vent of a female taken May 12, 1933.

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The Ophidian Generic Names *Ahaetulla* and *Dendrophis*

By Leonhard Stejneger

In a recent review of the ophidian genus *Dendrophis* by W. Meise and W. Hennig[1] an attempt to settle several grave nomenclatorial questions has been made, which shows the necessity of a thorough study of the early literature of some of the well-known green tree snakes of the Tropics.

Three species are particularly involved, as they were generally confused by the early authors on account of their great superficial resemblance in color and slenderness. The early descriptions, in so far as they emphasize these features, are therefore more or less composite and can not as a rule be referred to any individual type specimens. Fortunately, however, these snakes, which are now regarded as belonging to three genera and two families, are easily differentiated by the number of ventrals and subcaudals. Equally fortunate is the fact that the early writers mention the number of these shields in most of the specimens examined by them. Moreover, cotypes of the Linnean species are still preserved.

For the sake of brevity and clarity I give the scute formulas as they have been recorded by Boulenger for the three species involved and under the names used by him in his *Catalogue of Snakes in the British Museum,* as follows:

Vol. 2, p. 78 *Dendrophis pictus* (Gmelin) ventr. 165–190; subcaud. 122–164.

Vol. 2, p. 113 *Leptophis liocercus* (Wied) ventr. 151–167; subcaud. 140–173.

Vol. 3, p. 180 *Dryophis prasinus* (Boie) ventr. 203–235; subcaud. 158–207.

It is to be noted that both the minimum and maximum figures here quoted have been exceeded since Boulenger's catalogue was published, without however affecting the argument of the present discussion.

Coluber ahaetulla 1758

The earliest binominal designation encountered for any of these snakes. It was given by Linnaeus in 1758 (Syst. Nat., ed. 10, 1: 225). There are still in existence five of his specimens, two of which were previously described by him in the first volume of the *Amoenitates Academicae,* and three in the *Museum Adolphi Frederici.* He diagnosed the species as having 163 ventrals plus 150 subcaudals and a black line through the eye. Compared with Boulenger's figures above, this diagnosis throws the name to *Leptophis liocercus,* the correctness of which identification is attested by the fact that four of the types have been shown by Lönnberg (Bih. Svenska Vet. Akad. Handl., 22, sect. 4, No. 1, 1896: 6, 26) and by Andersson (Bih. Svenska Vet. Akad. Handl., 24, sect. 4, No. 6, 1899: 22) to belong to this South American species, which therefore at the former's suggestion properly now bears the name *Leptophis ahaetulla* (Linnaeus).[2]

However, the fifth specimen, included by Linnaeus in the same name,

[1] Die Schlangengattung *Dendrophis,* in *Zool. Anz.,* 99, pt. 11–12, 1932: 273–297.

[2] The average of the scute formulas of Linnaeus' four specimens is 163+155; that of Boulenger's twelve specimens 159+152.

belongs to a different species, having a scute formula of 166 ventrals and 120 subcaudals, and is identified by the same authors as Boulenger's *Dendrophis pictus,* a species which did not receive its name until 1789. Linnaeus' type material thus belonged, with but a slight exception, to *L. liocercus* Boulenger, and the rest of the synonymy cited by him, especially his quotation of "Gronovius, Mus. 2. p. 61. n. 24," refers also mainly to the same species. This conclusion is emphasized by Linnaeus' express exclusion because not seen by him (*op. cit.*: 227) of "Gronovius' No. 23," which belongs to a different species.

Coluber pictus 1789

Named by Gmelin (Syst. Nat., ed. 13, 1, pt. 3, 1789: 1116) who based it on species No. 23 of Gronovius, as revived by Boddaert in 1783 (Nova Acta Acad. Caes. Leopold.-Carol., 7: 24, No. 29), though not given a binominal appellation by either Gronovius or Boddaert. The diagnosis specifies 172 ventrals + 142 subcaudals and a black stripe on the sides of the body, consequently falls within the limits of Boulenger's *Dendrophis pictus,* and has generally been so accepted.

Coluber boiga 1789

In 1789, consequently in the same year as Gmelin, Lacépède (Hist. Nat. Serp., 2, pt. 1: 102) named a snake *Coluber boiga,* the decisive points of the diagnosis being 166 ventrals + 128 subcaudals and the narrow black line bordering the white line of the upper jaw. These characters unquestionably fix the species as synonymous with Boulenger's *Dendrophis pictus.* The scute formula 166 + 128 proves beyond peradventure that *C. boiga* has absolutely nothing to do with *Dryophis prasinus* of Boulenger, which has a minimum scute formula of 203 + 158, and that Meise and Hennig were in error when stating (p. 289) that "Lacépède beschreibt deutlich *Dryophis prasinus* Boie in: Hist. Nat. Serp., v. 2, p. 102," on the strength of which dictum they rule out the "*Ahaetulla boiga* K. P. Schmidt 1927 nec Lacépède, Bull. American Mus. Nat. Hist. v. 54, p. 445, Fusznote." They were led into this error because they had only been able to consult Bechstein's translation of Lacépède (Herrn de la Cepede's Naturgeschichte der Amphibien, 3: 425–430). Bechstein, however, omits any reference to Lacépède's diagnosis and his binominal appellation *Coluber boiga* on p. 120 of part 1, and confines himself to a translation of the expanded and compiled notes on the species on pp. 223–228 of part 2, to which he made additions of his own in footnotes, mostly referring to *L. ahaetulla.* The fact that this subsequent discourse to some extent includes matter taken from the accounts of *L. ahaetulla* by other authors, who like himself confused the two species, can of course not counteract the positive connection of the specific name *C. boiga* with the scute formula of 166 + 128.

Having thus demonstrated the identity of the two names *C. pictus* and *C. boiga,* the question arises as to which has priority, both books being credited with having been published in 1789. As far as I know, the exact dates of issue have not been ascertained, hence they may be regarded as being of the same date. The A.O.U. code of Zoological Nomenclature in a case of this character grants priority to the name appearing on the earlier

page of the book, in this case to *C. boiga* on p. 102, as *C. pictus* appears on p. 1116. The International Code, however, prescribes that "if the names are of the same date, that selected by the first reviser shall stand" (Art. 28). The first reviser, that is, the first author to publicly establish the relation of the two specific names is, as far as I know, Karl P. Schmidt, who (Bull. Amer. Mus. Nat. Hist., 54, 1927: 445) identified Lacépède's *C. boiga* with Gmelin's *C. pictus* on the strength of the name adopted in the MS card catalog of the U. S. National Museum. For the latter I was responsible, as at the time the cards were written I was under the impression that Lacépède's second volume was published in 1788 like the first volume and that consequently *C. boiga* had a year's priority. This appears to have been a mistake. Nevertheless, Schmidt's "revision" once made, I am afraid must stand under the strict interpretation of the International Code.

The Generic Names Involved

The first author to attempt a generic separation of these green tree snakes was H. F. Link in a small pamphlet published in 1807, entitled *Beschreibung der Naturalien-Sammlung der Universität zu Rostock. Zweite Abtheilung.* On p. 73 he established a new genus *Ahaetulla,* in which he included two species *A. fasciata,* a new name based on Bechstein's "Nat. 3. S. 425," which we have seen is essentially Lacépède's *Coluber boiga* and *A. mycterizans* based on Bechstein's "Nat. 4. S. 47." The latter quotation refers to Bechstein's translation of Lacépède's text to "La Nazique" (*op. cit.,* pt. 2: 47–49) without reference, however, to the specific name *Coluber nasutus* Lacépède (*op. cit.,* pt. 1: 100) which takes the place of the name *mycterizans,* as Linnaeus' type of the latter proves to be a specimen of the species known for many years as *Dryophis xanthozonia.*

Ahaetulla Link, 1807, as a generic appelation had been completely overlooked up to the time of Karl Schmidt's introduction of it in the combination *Ahaetulla boiga* in 1927 (Bull. Amer. Mus. Nat. Hist., 54: 445). Unfortunately he omitted specifically to designate this species as the type, Link of course not having made any selection. I say unfortunately, because the road was thus left open for Meise and Hennig (*op. cit.*: 296) to designate *A. mycterizans* Link as the type, thereby giving it precedence over *Passerita* Gray, 1825 (=*Dryophis* Fitzinger, 1826) with the unfortunate result that Gray's *Ahaetulla* of the same date (type *D. pictus*) has to give way and the name *Ahaetulla* is imposed on a group of snakes with which it has never before been associated, a transfer of names sure to cause confusion, whereas if *A. fasciata* had been selected, Gray's nomenclature of both genera would have been conserved.

However, the "subsequent designation" has been made, and the two species must be known henceforth as *Dendrophis boiga* (Lacépède) and *Ahaetulla nasuta* (Lacépède), while the third species, alluded to above as *Dryophis prasinus* (Boie), must stand as *Ahaetulla prasina* (Boie), and *Passerita zanthozonia* (Boie) becomes *Ahaetulla mycterizans* (Linnaeus), which is not the same as Link's *Ahaetulla mycterizans.*

To summarize the whole matter, the following partial synonymies are offered:

Genus Dendrophis

1825 *Ahaetulla* Gray, Ann. Philos., new ser., 10: 208 (not of Link, 1807).
1826 *Dendrophis* Fitzinger, Neue Class. Rept.: 29, 30 (substit. for *Ahaetulla* Gray, 1825, type designated by Fitzinger, 1843, *Dendrophis picta* Boie).

Dendrophis boiga (Lacépède)

1789 *Coluber boiga* Lacépede, Hist. Nat. Serp., 2, pt. 1: 102 (type locality, Borneo, *op. cit.*, pt. 2: 279).—*Ahaetulla boiga* Schmidt, Bull. Amer. Mus. Nat. Hist., 54, 1927: 445 (Hainan, China), 538 (Yunnan).—Cochran, Proc. U. S. Nat. Mus., 77, art. 11, 1930: 26 (Siam).—Mell, Lingnan Sci. Journ., 8, Dec. 1929: 210 (Yunnan, Hainan, Hongkong).—Gee, Bull. Biol. Yenching Univ., 1, 1930: 66 (Yunnan, Hainan).
1789 *Coluber pictus* Gmelin, Syst. Nat., ed. 13, 1, pt. 3: 1116 (type locality, none indicated).—*Dendrophis picta* Boie, Isis, 1827: 530.—*Dendrophis pictus* Boulenger, Cat. Sn. Brit. Mus., 2, 1894: 78.—Meise and Hennig, Zool. Anz., 99, 1932: 287.—*Ahaetulla picta* Smith, Bull. Raffles Mus., No. 3, 1930: 51 (Malay Peninsula).
1802 *Coluber decorus* Shaw, Gen. Zool., 3: 538 (type locality unknown; type in Brit. Mus.).—*Ahaetulla decorus* Gray, Ann. Philos., new ser. 10, 1825: 208.—*Dendrophis decorus* Fitzinger, Neue Class. Rept., 1826: 60 (Java).
1807 *Ahaetulla fasciata* Link, Beschr. Nat. Samml. Rostock., pt. 2: 74 (type locality, India).

The subspecies as recognized by Meise and Hennig (*op. cit.*: 287–290) would then stand as:

Dendrophis boiga boiga (Lacépède). Malay Archipelago to India, Burma, Siam, southern China, Philippine Islands.

Dendrophis boiga andamanensis (Anderson). Andaman Islands.

Dendrophis boiga bifrenalis (Boulenger). Ceylon.

Dendrophis boiga cyanochloris (Wall). Darjeeling, Upper Assam and Upper Burma.

Dendrophis boiga inornatus (Boulenger). Sumba Savu and Samao Islands, Malay Archipelago.

Dendrophis boiga intermedius (Mertens). Sumbava, Flores and Komodo Islands, Malay Archipelago.

Dendrophis boiga timorensis (Smith). Timor and Wetar Islands, Malay Archipelago.

Genus Leptophis

1825 *Leptophis* Bell, Zool. Journ., 2: 328 (type designated by Fitzinger, 1843, *L. ahaetulla* (Bell)).
1831 *Ahoetula* Gray, Synops. Spec. Rept., in Griffith's Anim. Kingd. 9: 93 (subst. for *Leptophis* Wagler (Bell)), (not *Ahaetulla* Gray, 1825).
1858 *Ahaetulla* Günther, Cat. Colubr. Sn. Brit. Mus.: 151 (emendation).

Leptophis ahaetulla (Linnaeus)

1758 *Coluber ahaetulla* Linnaeus, Syst. Nat., ed. 10, 1: 225 (type locality, "Asia, America"; co-types in Mus. Stockholm and Upsala).—*Leptophis ahaetulla* Bell, Zool. Journ., 2, 1825: 328 (part).—Lönnberg, Bih. Svenska Vet. Akad. Handl., 22, sect. 4, No. 1, 1896: 6, 27.
1758 *Coluber filiformis* Linnaeus, Syst. Nat., ed. 10, 1: 225 (type locality, "in Indies"; type in Mus. Stockholm).—Andersson, Bih. Svenska Vet. Akad. Handl., 24, sect. 4, No. 6, 1899: 23.
1823 *Coluber richardii* Bory St. Vincent, Dict. Class. Hist. Nat., 4: 588 (type locality, Guiane).
1824 *Coluber liocercus* Wied, Isis: 665 (type locality, Brazil).—*Ahaetula liocercus* Gray, Syn. Spec. Rept., in Griffith's Anim. Kingd., 9, 1831: 93.—*Leptophis*

liocercus DUMÉRIL and BIBRON, Erp. Gén., 7, 1845: 533.—*Dendrophis liocercus* SCHLEGEL, Physion. Serp., 2, 1837: 224.

1831 *Ahaetula linnei* GRAY, Syn. Spec. Rept., in Griffith's Anim. Kingd., 9: 93 (for *Coluber ahaetula* Linnaeus).

GENUS AHAETULLA

1807 *Ahaetulla* LINK, Beschr. Nat. Samml. Rostock, pt. 2: 73 (type, *A. mycterizans* Link=*Coluber nasuta* Lacépède, designated by Meise and Hennig, 1932).

1820 *Dryinus* MERREM, Tent. Syst. Amph.: 136 (same type) (not *Dryinus* Fabricius, 1804).

1825 *Passerita* Gray, Ann. Philos., new ser., 10: 208 (subst. for *Dryinus* Merrem preoccupied).

1826 *Dryophis* FITZINGER, Neue Class. Rept.: 30 (subst. for *Dryinus*).

1830 *Tragops* Wagler, Nat. Syst. Amph.: 184 (type designated by Fitzinger, 1843, *Dryophis prasina* Boie).

1837 *Dryiophis* SCHLEGEL, Physion. Serp., pt. 2: 241 (emendation).

1843 *Herpetotragus* FITZINGER, Syst. Rept.: 27 (type, *Dryophis nasuta*).

1848 *Dystyches* GISTEL, Naturg. Thierr.: xi (subst. for *Tragops* Wagler).

1860 *Tropidococcyx* GÜNTHER, Ann. Mag. Nat. Hist., 6 (3): 428 (type, *T. perroteti*).

1886 *Gephyrinus* COPE, Proc. Amer. Philos. Soc., 23: 492 (type, *Dryophis fronticinctus* Günther.

1898 *Dryopsis* LIDTH DE JEUDE, Mus. Pays-Bas, 10, pt. 2: 38 (err. typogr.).

Ahaetulla nasuta (Lacépède)

1789 *Coluber nasutus* LACÉPÈDE, Hist. Nat. Serp., 2, pt. 1: 100 (type locality, Ceylon, Guinea, Carolina, *op. cit.*, pt. 2: 279).—*Dryinus nasutus* MERREM, Tent. Syst. Amph., 1820: 136.—*Dryiophis nasuta* SCHLEGEL, Physion. Serp., pt. 1, 1837: 159; pt. 2: 246.—*Dryophis nasutus* ANDERSSON, Bih. Svenska Vet. Akad. Handl., 24, sect. 4, No. 6, 1899: 15.—*Passerita nasuta* COCHRAN, Proc. U. S. Nat. Mus., 77, art. 11, 1930: 32 (Siam).

1802 *Coluber mycterizans* LATREILLE, Hist. Nat. Rept., 4: 122 (based on Lacépède's Nazique; not of Linnaeus).—DAUDIN, Hist. Nat. Rept., 7, 1803: 9.—*Ahaetulla mycterizans* LINK, Beschr. Nat. Samml. Rostock, 2, 1807: 74.—*Dryinus mycterizans* MERREM, Tent. Syst. Amph., 1820: 136.—*Passerita mycterizans* GÜNTHER, Cat. Colubr. Sn. Brit. Mus., 1858: 160 (part).—*Dryophis mycterizans* BOULENGER, Cat. Sn. Brit. Mus., 3, 1896: 182.

1826 *Dryophis hammatorhynchus* FITZINGER, Neue Class. Rept.: 61 (subst. for *Coluber mycterizans* Daudin, not Linnaeus).

Ahaetulla mycterizans (Linnaeus)

1758 *Coluber mycterizans* LINNAEUS, Syst. Nat., ed. 10, 1: 226 (type locality, "America").—*Dryophis mycterizans* ANDERSSON, Bih. Svenska Vet. Akad. Handl., 24, sect. 4, No. 6: 15.

1827 *Dryophis xanthozonia* BOIE, Isis: 545 (type locality, Java).—*Passerita xanthozonia* SMITH, Bull. Raffles Mus., No. 3, 1930: 66 (Malay Peninsula).

1896 *Dryophis xanthozona* BOULENGER, Cat. Sn. Brit. Mus., 3: 180 (emendation).

Ahaetulla prasina (Boie)

1827 *Dryophis prasina* BOIE, Isis: 545 (type locality, Java).—*Dryophis prasina* BOULENGER, Cat. Sn. Brit. Mus., 3, 1896: 180.—*Passerita prasina* STEJNEGER, Medd. Zool. Mus. Kristiania, No. 2, 1922: 4 (Borneo).—SMITH, Bull. Raffles Mus., No. 3, 1930: 66 (Malay Peninsula).—COCHRAN, Proc. U. S. Nat. Mus., 77, art. 11, 1930: 32 (Siam).

1854 *Tragops xanthozonius* DUMÉRIL and BIBRON, Erp Gén., 7: 826 (Cochin-china) (not of Boie).

U. S. NATIONAL MUSEUM, WASHINGTON, D. C.

Secondary Sexual Characters of *Bufo melanostictus* Schneider

By Gordon Alexander

THE secondary sexual characters of amphibia have proved of considerable taxonomic importance, and have consequently been studied in considerable detail. The best recent summary of these is probably that of Noble (1931), who gives numerous references. The present paper is a summary of these characters as they have been observed in the common toad of southern Asia, *Bufo melanostictus* Schneider.

Schneider's original description (1799) does not include mention of sexual differences; but one male character, *viz.*, possession of the sub-gular vocal sac, was noted and recorded as early as 1841 by Duméril and Bibron under the synonym *Bufo scaber* Daudin (part). Stejneger (1907) described in detail the external features of the two sexes from preserved specimens collected in Formosa. Only one specimen of each sex was described in detail, however, and it is therefore not unusual that the writer has found that certain of the recorded differences are not constant.

My observations are based primarily on the detailed examination of 27 males and 41 females, and examination of certain external characters of 5 additional males, all collected, and examined fresh, at Bangkok, Siam, between October, 1928, and May, 1930. These were the largest individuals from a total collection of over 200. The large series in the American Museum of Natural History has been subsequently studied, through the courtesy of Mr. Clifford H. Pope, who collected most of the specimens. I am indebted to my colleagues in Chulalongkorn University, Bangkok, for much assistance during the course of the studies in Bangkok.

The sexual differences are here treated in two groups, qualitative, and quantitative.

Qualitative Differences between the Sexes

BEHAVIOR.—Pressure on the sides of the body, behind the fore-limbs, of all mature males elicited the croak reflex. The croak was a guttural trill, not particularly loud. The same treatment of females was followed usually by considerable swelling of the body, and often by forcible discharge of urine.

SUB-GULAR VOCAL SAC.—Males possess a black-pigmented, sub-gular vocal sac, which usually opens into the pharynx by a single, asymmetrically located slit. Of the 13 males examined for this character, 8 had the opening on the right side of the tongue (Fig. 1a), 4 on the left side, and one had two openings, placed bilaterally (Fig. 1b). Duméril and Bibron (1841) and Stejneger (1907) described specimens with bilateral openings, but made no mention of the apparently more usual unilateral condition.

COLOR.—The most consistent external difference between the sexes was found to be the color of the upper throat. Flower (1896) thought the "bright yellow" chin of males was confined to the breeding season.

In Bangkok, all mature males observed had a dull copper-yellow throat. The same area in females was always light gray or gray-buff. No seasonal variation was observed.

The preserved specimens in the American Museum collection show traces of yellow on the throat of males, and the black of the sub-gular sac shows through the skin in most if not all specimens. The latter condition was not nearly so noticeable in the living material, the alcohol apparently clearing the skin to some extent. Pope (1931) failed to find any sex difference in color, and the writer has found no consistent difference other than that here described.

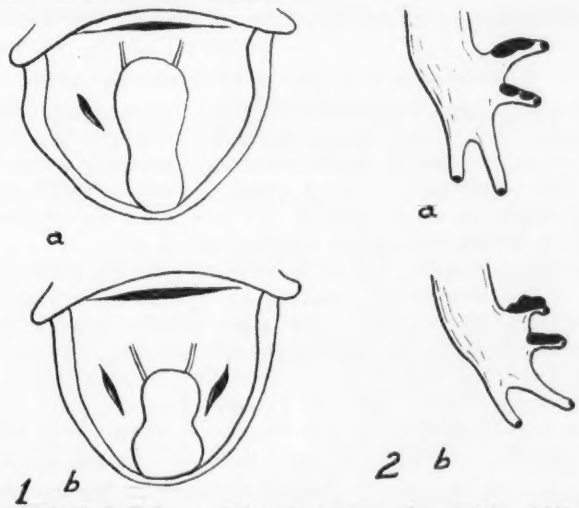

Fig. 1. The floor of the mouth in males having unilateral (a) and bilateral (b) openings into the vocal sac. One and one-fourth times natural size.

Fig. 2. Pads of the two inner fingers of males in breeding condition. Specimens collected in October (a) and March (b). One and one-fourth times natural size.

DIGITAL SWELLINGS.—The two inner fingers of males were provided on the upper surface with pads which varied in color from pale gray to intense black. The size was more or less proportional to the degree of blackness. Fig. 2 illustrates the conditions in two males collected at Bangkok. The pads were black in both. The pads appear elongate in Bangkok specimens, and American Museum specimens from Nodoa Hainan (18 males examined), and Yenping (Fukien Province) China (5 males examined); but, strangely, they are small and round in 7 males examined from Futsing Hsien (Fukien Province).

WEBBING OF TOES.—Stejneger's specimens differed in that the webs of the toes of the males were smaller than those of the female. This represents the average condition in Bangkok specimens, but there were occasional males with webs as pronounced as those of females.

METATARSAL TUBERCLES.—Stejneger's specimens differed in the relative size of the metatarsal tubercles, the outer being larger than the

inner in the female, *vice versa* in the male. This does not seem to be a consistent difference. Of the 18 Bangkok specimens examined for this character, the "female" condition occurred in one male, the "male" condition in 6 females, and in 3 females the condition was reversed on the two feet. The remaining 8 only, 5 males and 3 females, showed the described difference. The indication is, therefore, that in males the inner metatarsal tubercle is usually the larger, whereas there is no consistent difference in females.

BIDDER'S ORGAN.—The writer has already pointed out in this journal (1932) the fact that Bidder's organ remains throughout life in males, but has a tendency to disappear in the majority of females after they attain maturity.

QUANTITATIVE DIFFERENCES BETWEEN THE SEXES

The actual figures are summarized in the accompanying tables.

WEIGHT.—The mature females averaged considerably larger than the mature males, and attained a maximum size considerably greater.

LENGTH.—Differences in length (snout to vent) seemed less striking than in weight, as to be expected, but here again the maximum size attained by females considerably exceeded that of males.

The largest specimen seen at Bangkok, of over 200 collected, was a female of 108 mm. length, weighing 140 grams. The ovary in this specimen weighed 18 grams. Two other females weighing over 100 grams were collected. The largest male taken weighed 95 grams, and was 92 mm. long. The next largest male collected weighed only 68 grams, still considerably heavier than the average. Flower (1896) reported a specimen from Penang of 115 mm. length. It seems certain that Boulenger's statement (1890), "from snout to vent 6.5 inches," was an error.

TABLE I

SEXUAL DIFFERENCES IN WEIGHT, LENGTH, AND RATIO OF MUSCLE WEIGHT TO BODY WEIGHT

Data on weight and length from 27 males and 41 females. That on muscle weight available from only 28 individuals,—10 males and 18 females, collected between October, 1929, and May, 1930.

	Weight (gms.)			Length (mm.)			Ratio: Muscle Weight / Total Body Weight		
	Min.	Max.	Ave.	Min.	Max.	Ave.	Min.	Max.	Ave.
Males	30.9	95	46.7	65	92	78.2	0.0118	0.0160	0.0137
Females	32.4	140	70.4	68	108	88.3	0.0103	0.0142	0.0122

MUSCLE WEIGHT.—The muscle weight of the male averaged greater in proportion to the total body weight than did that of the female. The figures here given are based on weights of the two gastrocnemius muscles weighed together, on a balance accurate to one-tenth milligram. Such a balance was not available for the earlier studies, and the weights then recorded are not included in the figures given.

THICKNESS OF FOREARM.—The greater thickness of the male forearm was obvious in most specimens. To secure a quantitative statement of the difference the writer recorded measurements of minimum wrist diam-

eter, maximum forearm diameter, and foream length (point of elbow to proximal margin of inner palmar tubercle). The most pronounced and consistent sexual difference found was in the ratio of forearm diameter to forearm length. The wrist of the males was proportionately thicker than that of females, but in absolute measurement averaged smaller.

THICKNESS OF PREPOLLEX.—The "thumb" averages only slightly thicker in males than in females, as brought out by determining the ratio of the horizontal diameter at the base to the length. The latter figure was obtained by averaging the measurements of inside and outside length. A pronounced difference which may characterize breeding individuals is lost here in such a general population.

TABLE II
SEXUAL DIFFERENCES IN THICKNESS OF FOREARM AND PREPOLLEX

Data from 10 males and 20 females collected at Bangkok, between September, 1929, and May, 1930.

	Ave. Wrist Diam.	Forearm Ave. Diam.	Forearm Ave. Length	Ratios: Wrist / Forearm Diam.	Ratios: Forearm Diam. / Forearm Length	Ratios: Wrist / Forearm Length	Ratio: "Thumb" Diam. / "Thumb" Length Min.	Ratio: "Thumb" Diam. / "Thumb" Length Max.	Ratio: "Thumb" Diam. / "Thumb" Length Ave.
Males	6.27	8.89	18.24	0.705	0.487	0.344	0.34	0.46	0.40
Females	6.51	8.02	20.22	0.812	0.396	0.322	0.31	0.45	0.37

The measurements of forearm and prepollex were complete for only the last 30 Bangkok specimens studied. These were 20 females and 10 males.

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The *Pseudemys troostii-elegans* Complex, a Case of Sexual Dimorphism

By Percy Viosca, Jr.

MANY thousands of baby turtles are shipped out of Louisiana every year for the pet shop and aquarium trade and all can be readily identified, *Pseudemys elegans* being the most common. For a number of years I have noted the total absence of specimens identifiable as young of *Pseudemys troostii* in such collections. It then dawned upon me that perhaps *troostii* was a melanistic adult phase of *elegans*.

Meanwhile C. S. Brimley, under date of August 8, 1927, writes:

> In working up the genus *Pseudemys* I have been struck by the fact that the only differences I can find given between *P. elegans* and *P. troostii* are adult color characters, which are mainly a suppression of or absence of markings in the latter. About the only positive color character is the presence of vertical black bars on the upper jaw in *troostii* and their absence in *elegans* as in all other *Pseudemys*. I can find no record of any differences in the young nor any reference whatever to the young of *troostii*.
>
> *Floridana, concinna* and *rubriventris* are easily distinguished in the newly hatched young by color pattern of upper or under side, as is also *scripta* from *elegans*, but how the latter and *troostii* differ I have been unable to find out.

During the fall of 1929 I had occasion to observe a mixed collection of turtles from Lake Bruen, near St. Joseph, Louisiana. Eight of these I classed as *troostii* and twenty-six as *elegans*. None of the *troostii* were under 6 inches (carapace length), whereas twelve of the *elegans* were between 4 and 6 inches. I did not note the sexes in that lot. Subsequently I discovered that all specimens of *troostii* in my collections or passing through my hands were males, and that in this sex there were occasional intermediates between *troostii* and *elegans*, usually between 5½ and 6½ inches.

It was my good fortune recently to secure by purchase several hundred turtles collected during April, 1933, in the vicinity of Rayne and Lake Arthur, in southwest Louisiana. The collection was a promiscuous lot taken as they could be captured, except that none under four inches were gathered. These were closely observed, measured, and classified as follows:

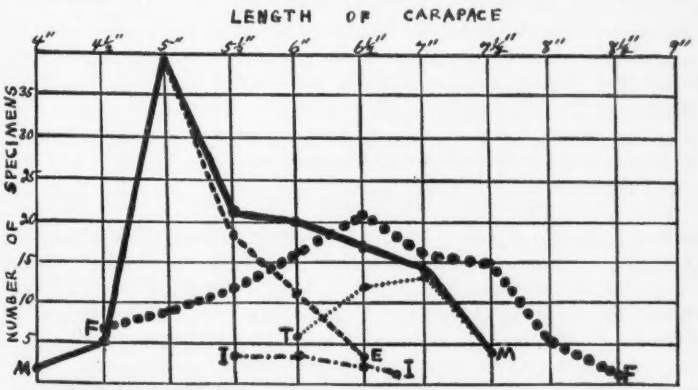
	Number	*Size Range*	*Ave.*
Males with *elegans* characters dominating	79	4 to 6½ in.	5+ in.
Males intermediate between *elegans* and *troostii*	9	5½ to 6¾ in.	6 in.
Males with *troostii* characters dominating	35	6 to 7½ in.	6½ in.
Males, total	123	4 to 7½ in.	5½ in.
Females, all with *elegans* characters	102	4¼ to 8½ in.	6¼ in.

It is seen that the males averaged smaller than the females and that their maximum length is 7½ inches whereas that of the females is 8½ inches. The results are shown graphically in the accompanying figure. The males were divided into three groups. It was found that none over 6½ inches exhibited clearly the *elegans* characters as shown by the curve ME, whereas, none under 6 inches exhibited clearly the *troostii* characters as shown by the curve TM. The intermediates (curve II), that is those which could not be classed easily as *elegans* or *troostii*, ranged from 5½ to

nearly 7 inches and were a small minority of the total number of males. There is no significant change in the color characters of the females (curve FF) as they approach maturity, although the young can be said to be more brilliant and strikingly marked.

All males under 5½ inches are essentially like the females in their markings although as they approach that length, they show a creeping in of the *troostii* characters. It would appear that they pass through the transformation stage rather quickly because the number of true intermediates is comparatively small. The *elegans* characters, however, are never totally lost, but in the main are suppressed or obscured by the appearance of the *troostii* characters, which is a phenomenon of melanism.

The transformation seems to be as follows: A dark olive brown color



Graph illustrating sexual dimorphism in a collection of 225 specimens of *Pseudemys troostii* (Holbrook) over four inches in length.
MM Curve for all males.
ME Curve for males with *elegans* characters dominating.
II Curve for males intermediate between *elegans* and *troostii*.
TM Curve for males with *troostii* characters dominating.
FF Curve for all females.

appears along the sutures of the carapace and gradually spreads, sometimes eventually obscuring entirely the lighter lines and veinings. At the same time, the bright green, orange or creamy yellow lines darken through shades of olive, the contrast between them and the dark olive brown markings growing less with age. The broad transverse bar in each costal plate is the last to become obscured. On the plastron, the large characteristic circular or subcircular spot on each plate usually fades out. This is especially noticeable on the forward plates. While this is occurring, there appears on each plate two concentric circles of small black dots, which appear in a position eccentric to the position of the former circular spots which they replace. The symmetry may become obscured by these in turn giving way to a pattern of somewhat irregular vermiculate spottings. A dark brown color now appears along the sutures of the plastron and spreads over the ventral plates. This, in very melanistic individuals, may

obscure the light color and the vermiculate spottings almost entirely. In all cases observed, this darkening of the plastron is more pronounced in the posterior region. The bright red bar on the head behind the eye at first changes to a dull red and may become entirely obscured in old individuals. At the same time, vertical dark spots or bars may appear on one or both jaws. Longitudinal rows of dark spots appear on the head, later fusing into irregular vermiculate markings as the light lines of *elegans* are obscured. Eventually the whole head may become dark olive brown and suggestions of lines or vermiculations may disappear. The adult males also exhibit the longitudinally rugose costal plates, considered as a *troostii* character.

Of course in *elegans,* both sexes are very variable. This applies both to the markings, and to the degrees of melanism exhibited. Melanistic females do not exhibit the *troostii* characters, however. The back may be dark brown (nearly black and not olivaceous) and there are fewer light lines, but the central bars on the costal plates of the specimens observed are a bright creamy orange contrasting with, rather than blending into the dark areas. The plastron may be dark brown, leaving only a few yellow spots and yellowish edges. The melanistic phenomenon in the females is not a spreading of the dark color along and out from the sutures as is the case in the males.

After the above observations were made, I had an opportunity to examine critically a collection of 300 young turtles from Plaquemine, Louisiana, a region where both *troostii* and *elegans* adults are common. The specimens were nearly a year old, being collected during early July, whereas the new crop had not yet made its appearance. Two hundred and thirty-five of the lot were identifiable as *elegans* and none as *troostii,* the remainder belonging to other readily identifiable species. The carapace length in the *elegans* lot varied from 2 to 2½ inches, the average being about 2¼ inches.

The typical plastron pattern consisted of one dark spot in each plate. Most of them also showed evidence of the two concentric rings which remain for a time on *troostii* individuals after the round spots fade out. A fair percentage showed additional spottings in the region of the median and lateral sutures of the plastron. In six specimens this pattern is at least as conspicuous as the typical pattern, while in one specimen it replaces the typical pattern entirely. Thus while in a very small percentage of individuals there is a suggestion of *troostii* characters on the under side, the upper side, while very variable, does not offer *troostii* suggestions.

It is evident from the above observations that the *Pseudemys troostii-elegans* complex is simply a case of sexual dimorphism, and that the type described by Holbrook as *Emys troostii* is simply the adult male form, whereas the type described as *Emys elegans* by Wied is represented by young males and all females. Since Holbrook's description (1836) antedated that of Wied (1838) the term *elegans* becomes a synonym, and both forms must be known as *Pseudemys troostii* (Holbrook).

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On the Immunity of Rattlesnakes to Their Venom

By A. A. Nichol, Volney Douglas and Lewellyn Peck

"RATTLESNAKES are immune to their own and each other's venom." This frequently occurring statement stands alone in the literature without record of experimental work on which it might logically be based.

Recently H. K. Gloyd[1] has recorded the fatal effects to a rattlesnake of the bite of a cottonmouth moccasin. He also reports on the observations on three other crotalid snakes bitten by themselves or by other snakes, and from which no harmful effects followed.

In this locality so many accounts have been told by stockmen and hunters of instances where rattlesnakes have died after being bitten by themselves or by other rattlesnakes that we conducted the following trials to see what definite information could be found on the much debated question.

In August, 1932, two black-tailed rattlesnakes (*Crotalus molossus*), were induced to bite each other. These snakes were uninjured, in good health, and had been kept in a cage without feeding to allow a reasonable amount of venom to accumulate in their poison glands. In conducting the tests the snakes were held in the hands, firmly but without causing the least injury to the snakes. The larger snake was 33 inches long and the smaller 28 inches. The latter had always been irritable and when part of the body of the larger snake was presented to his fangs he readily sank them with the ejection of poison. The place of entry was in the fleshy tissue of the back above the anus. The larger snake immediately became infuriated and when the dorsal mid-region of the smaller snake was offered he quickly struck twice. In neither snake did the fangs reach the body cavity or any internal organ.

For a few moments both snakes writhed violently about, then became limp and lethargic. In two hours and forty minutes from the time the smaller rattlesnake had been bitten he died. Examination showed a bluish-green discoloration for approximately three inches on each side of the fang punctures. A general histolysis of the tissue was present throughout this area, the skin was transparent, and the bones fell apart upon the least touch.

At the end of six hours the other snake was still alive, though barely so, and since histolysis was proceeding rapidly and the skin was wanted for specimen purposes this snake was killed to save the skin from further decomposition. From the anus to the rattles the same condition appeared as in the other snake.

In September, 1932, a 34-inch desert rattlesnake (*C. atrox*) was bitten in the mid-region of the back by a 48-inch snake of the same species. Due to the twisting of the snakes one fang was prevented from entering and much of the poison was spilled on the scales of the smaller snake. For an hour the bitten individual was unnaturally active and kept up an almost

[1] H. K. Gloyd, On the Effects of Moccasin Venom Upon a Rattlesnake. *Science*, 78, No. 2010, July 7, 1933: 13–14.

continuous rattling. Twenty-five hours later a thin, serous fluid tinged with blood flowed from the snake's mouth; this kept up for two and one-half hours at the end of which time the snake died. Histolysis was present in the tissues of the left body wall for a length of 4 inches where the snake had been struck. The lungs were full of lymph and uncoagulated blood.

Before the smaller snake had been bitten the venom had been extracted from its poison sacs; and 4 minims were hypodermically placed in the back muscles of the larger snake approximately ½ inch to the side of the spinal column and 10 inches behind the head. Following this the snake proved very irritable for 2 hours, continually rattling and cruising about its cage. Shortly after the injection of venom a decided stiffness appeared in the body for 3 or 4 inches on each side of the puncture and this section of the body remained straight as the snake moved about. Toward the end of two hours this stiffness disappeared and from then on the snake showed no effects of the treatment.

Air temperatures during this second trial were: Maximum 103°, minimum 67°. Venom was administered to the snakes at the maximum temperatures. The minimum temperatures were reached approximately fifteen hours later.

On August 11, 1933, one *Crotalus atrox* was released from its cage preparatory to extracting the venom. Evidently resentful at the attempted use of a stick to pin its head down, it turned suddenly and viciously struck its own tail midway between rattles and anus. The fangs entered directly on top and the punctures were one full inch apart. Blood ran freely for five minutes from both wounds. Within an hour the tail had swollen to twice its normal size and for several hours the snake refused to rattle when disturbed. Twenty-four hours later the tail was noticeably more swollen but the snake would rattle when disturbed. For the following two hours it became very restless, moving about continually, though very slowly. Breathing then became much labored and it stopped crawling around. For the next hour life was difficult to detect except when there was an occasional strained effort at respiration. The snake died just twenty-seven hours after it had bitten itself. The tail was much swollen throughout and of a dark greenish color. There was a general histolysis of all the tail tissue.

On the same day two black-tail rattlesnakes 30 and 40 inches long respectively were induced to bite each other. The larger snake was bitten on the dorsal surface halfway between anus and rattles. A small amount of blood flowed from each puncture. Swelling was pronounced within an hour after which time the snake refused to rattle. Five hours later the snake would again rattle but the tail remained swollen. Twenty-five hours after being bitten respiration became labored and the snake became very restless for an hour and a half. It then stopped moving and appeared lifeless except for occasional periods when four or five labored inhalations would be made after which it would lapse into a lethargic state. It died twenty-eight hours and ten minutes after being bitten.

The smaller snake was bitten by the larger a foot and 2 inches from the rattles. The wound was in the muscles of the back, and decided swelling

had taken place at the end of an hour. In the region of the bite 6 or 7 inches of the body became stiffened. Exhibiting little noticeable restlessness this snake died nine hours and fifty-five minutes after being bitten. Both individuals showed a breakdown of the tissues similar to the other snakes. Exact air temperatures are not known for the time the trials were conducted with the above three specimens. The snakes received the poison at 1 P.M. at which time the temperature was within a few degrees of 100°.

On August 26, several cubic centimeters of venom were removed from three 5-foot specimens of *C. atrox* that are in the snake pits on the University campus. A 29-inch specimen of *C. atrox* was given a hypodermic dose of 25 minims of venom 4 inches behind the head. This was slowly and carefully introduced into the muscle tissue on the right side of the back. For twenty minutes this snake held itself in a coiled position of defense, never making, however, any attempt to strike when provoked. Following this time the snake rapidly became limp and serum and blood flowed freely from its mouth until it died four hours and forty-five minutes from the time of injection of the venom. No swelling was noticeable on this snake. The lungs were flooded with lymph and uncoagulated blood, and histolysis of the muscle tissue had proceeded to a degree that left the flesh in the area of injection in a semi-fluid state.

At the same time another 28-inch *C. atrox* was injected with 5 minims of venom midway between anus and rattles. Swelling of the tail appeared in less than an hour, followed by discoloration visible through the skin. For thirty-six hours this snake was extremely irritable. It died forty-five hours after the venom was injected. The air temperatures were: Maximum 97°, minimum 66°. The venom was injected into the snakes at the time of maximum temperatures.

Three other rattlesnakes, each of which was given less than 5 minims of venom hypodermically, all recovered with local swelling appearing in from one to five hours.

We have had other snakes die from similar trials but these were discarded since more or less injury had taken place in the handling of the snakes, and it was not certain that the venom alone produced the fatal effects. Excessive temperatures were avoided in handling these snakes. At no time were they exposed to the sun or to more heat than they would normally seek in their natural environment.

The high temperatures existing at the time of these trials would, theoretically at least, create conditions under which the venom would be more active than under low air and snake body temperatures.

These snakes weighed from 1 to 4 pounds. Four minims of poison did not prove fatal to the larger snakes. If the human body of an average adult weight of 150 pounds was of the same relative susceptibility to the venom as are the rattlesnakes, as indicated by the dosages given, it would require over 10 cubic centimeters of poison to produce fatal results. This is possibly ten times more than the average sized rattlesnake of the southwest carries at any time.

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Herpetological Notes

NOTES ON *COLUBER OAXACA,* AND *MASTICOPHIS MENTOVARIUS.*—Dr. Ditmars recently received some living snakes from the vicinity of Colima, Mexico, and sent some of them to the Museum of Comparative Zoology for identification. Among them was a specimen of the very rare *Coluber oaxaca,* which he kindly presented to the Museum. I am indebted to the authorities of the Museum for the privilege of examining this snake and of reporting on its characters.

The specimen is a male, 800 mm. long, of which the tail takes up 230 mm. The head is 10 mm. wide and 22 mm. long, so that the ratio of length to width is .45. The maxillary teeth are 16 in number, increasing posteriorly, with no gap in the dentition. The hemipenis has three basal hooks, the spines are in about 17 longitudinal rows, with about six hooks to a row. The hooks grade into calyces in such a way that it is difficult to make a count of either, but there are about three cross rows of calyces around the organ, with about two additional rows in each lobe. The total count of hooks is about 90.

The snake is a light olive brown above and cream color below.

There are eight upper labials, the fourth and fifth bordering the orbit. Lower labials are nine in number, four of which are in contact with the anterior chin plates, which latter are slightly longer than the posterior. There are two preoculars, the lower being very small, and two postoculars. Temporals are: 2-2-2 on the left side and 1-2-2 on the right. The ventrals are 165, the anal is divided, and the paired subcaudals are 102. The dorsal scales are 15 anteriorly. At about midbody the seventh rows (the paravertebral) drop out leaving 13, which continue until about 75 mm. anterior to the vent, where the third rows drop out leaving 11 scale rows.

Ortenburger has divided *Coluber* (containing one set of vicarious forms) from *Masticophis* (containing two such series) on the basis of a number of rather slight characters. The snake under discussion agrees with *Coluber* rather than *Masticophis* in hemipeneial characters, and in the number of ventrals. In maxillary dentition, in caudal count, and in ratio of head width to head length it agrees with both. In dorsal scutellation and in number and arrangement of upper labials it fits Ortenburger's definition of *Masticophis* better than his definition of *Coluber.* I find Ortenburger's definition of the existing species unexceptionable, but I am extremely sceptical as to his division of them into two genera. The specimen which I have just described goes a long way towards breaking down his definitions.

It might also be noted that *Masticophis mentovarius,* whose range according to Ortenburger is Mexico to Guatemala, ranges to Managua, Nicaragua (U.S.N.M. No. 79961); La Palma, Costa Rica (B.M.N.H. No. 1913-7-19-145); Panamá, no specific locality (U.S.N.M. No. 53626, Collegio La Salle).—E. R. DUNN, *Haverford College, Haverford, Pennsylvania.*

NOTES ON *LICHANURA.*—Two years ago I published[1] some notes on *Lichanura,* including a description of the desert boa as a new subspecies, and a map of localities of the known specimens of the genus. Since then several additional specimens of interest have come to hand.

A GENUS NEW TO MAINLAND MEXICO

As *Lichanura roseofusca gracia* had been collected in the Gila Mountains in southwestern Arizona it was rather to be expected that specimens would be found in some of the scattered, barren mountains which rise through the floor of the desert just across the boundary to the south. It was, however, with a distinct sense of surprise that I received last May, through the kindness of Mr. Andres Kux of Ciudad Obregon, a little boa of this genus taken in a garden close to the seashore at Guaymas, Sonora. This extends the range nearly 400 miles to the south, as far as the mainland (as opposed to peninsula Lower California) is concerned.

The specimen in question has the following characteristics: Female; length over all 672 mm., tail 91 mm., head 23½ mm.: 39 dorsal scale rows, 226 ventrals, 48 caudals, 14–14 supralabials, 16–15 infralabials, 10–10 oculars; colors in life: three even, dorsal dark stripes of Bone Brown[2]; interspaces, Light Pinkish Cinnamon; ventral surface,

[1] *Trans. San Diego Soc. Nat. Hist.,* 6, No. 20, April 30, 1931: 305–318.
[2] Capitalized color names refer to Ridgway, Color Standards and Nomenclature, 1912.

Pale Pinkish Buff. Stomach contains mammal hair. Three developing eggs.

In general, it may be said that this Mexican specimen agrees exactly with *Lichanura trivirgata* in color but the scale counts (as will be seen by comparison with the table on page 309 of the previous paper) are high for *trivirgata* and show closer agreement with *gracia*. Thus, in a way, this new specimen may be considered a *trivirgata-gracia* intergrade; however, before suggesting that the two northern forms be designated as *L. trivirgata roseofusca*, and *L. t. gracia*, respectively, I think it will be well to await the collection of more material between Guaymas and southern Arizona, or in central Lower California. Although additional specimens of *trivirgata* and *gracia* have come to hand during the last two years, none has been found in the gap of more than 500 miles between El Rosario and La Paz, that is, the entire central stretch of Lower California. Thus, a direct intergradation between these two forms is far from demonstrated, if we except the Guaymas specimen, and the latter does not present a simple geographical picture of relationship, as the Gulf of California is interposed.

Roseofusca-gracia Intergrades

I have lately seen two boas which might be considered *roseofusca-gracia* intergrades. The first was from Twenty-nine Palms, San Bernardino County, California; it had distinct dorsal stripes, but the edges were irregular, thus falling between the chaparral dwelling *roseofusca* and the even-striped snakes from such Mohave Desert localities as Victorville, Oro Grande, and Randsburg. This tendency toward intergradation is here more pronounced than in the desert-edge specimens from eastern San Diego County, which, for all their contrasting colors, remain essentially *roseofusca roseofusca*.

The second new specimen is from 10 miles north of El Rosario, Lower California, and has stripes not so well defined as a specimen previously reported from near Socorro. These two localities are but a few miles apart. A considerable series from San José, some 50 miles to the north of Socorro, show virtually no striping; the snakes are rufous and almost unicolor. Thus, the presence of the striped desert form, *gracia*, is demonstrated both to the north and south of the unicolor or mottled *roseofusca* of the San Diegan faunal area, with intergrades on both flanks.

A Brood of Boas

Broods of the California boa have not been frequently observed. It will therefore be of interest to give the data on such a brood born to a mother at the San Diego Zoo, November 16, 1932. As is so often the case with captive specimens, the birth was not normal, and even the date may not represent what occurs in nature. The mother had been collected at Mission Gorge, San Diego County, and had been in captivity since about September first. Of the six young, three were born dead, one of these being stunted and quite defective. The other three lived only a short time, six days being the maximum.

In color, the little boas were typical of the San Diegan, or *roseofusca*, form, the ground color being somewhat lighter than in adults, but the longitudinal lines exceedingly irregular.

The statistics of the mother and brood are presented in tabular form. It is interesting to note how the young follow the mother in the asymmetry of the subloreals.

BROOD OF *LICHANURA ROSEOFUSCA ROSEOFUSCA*

Number	9602 (Mother)	9603	9604	9605	9606	9607	9607 (Defective)
Sex	F	M	F	M	F	F	
Length over all	860	298	305	299	295	299	210
Tail length	112	35	35	36	35	35	31
Scale rows	41	39	39	41	39	41	
Ventrals	236	243	239	235	235	235	
Caudals	49	50	48	50	46	47	
Supralabials	13–11	14–14	14–14	14–15	14–13	13–14	
Infralabials	15–15	13–13	15–14	14–15	14–14	14–13	
Oculars	8–8	8–8	9–9	8–9	10–9	9–9	
Loreals	2–2	2–3	3–3	3–3	3–2	3–3	
Subloreals	2–1	2–1	2–2	3–1	2–1	1–1	
Oculars in contact with supralabials	2–2	2–2	2–2	2–2	2–2	3–3	

Dimensions in millimeters; measurements made before specimens had set in preservative.

L. M. Klauber, *Natural History Museum, Balboa Park, San Diego, California.*

LATE AUTUMN COLLECTIONS AND HIBERNATING SITUATIONS OF THE SALAMANDER *HEMIDACTYLIUM SCUTATUM* (SCHLEGEL) IN SOUTHERN MICHIGAN.—The places where *Hemidactylium*, the four-toed salamander, has been found assembled in late autumn indicate where it spends the winter. On November 5, 1922, eighteen were found in and adjacent to a single short (six foot) log in a piece of woods in Whiteoak Township, Ingham County. They were in the cavities of the rotted wood and under leaves close by. In association with them were a number of other amphibians (1 *Plethodon cinereus*, 6 *Ambystoma jeffersonianum*, 1 *A. maculatum*, 4 *Triturus viridescens*) and a garter snake, *Thamnophis sirtalis*. Since only one other specimen of *Hemidactylium* was found on this day, it was very likely more than a coincidence that so many were found together.

It has not been an unusual occurrence in collecting in late autumn to find amphibians concentrated in this way. On another occasion, large numbers of *Hemidactylium* were collected under leaves within an area of a very few square feet. They were associated with great numbers of several other species, the whole group amounting to:

Four-toed salamanders (*Hemidactylium scutatum*) .....nearly 200
Spring peepers (*Hyla crucifer*) 114
Swamp tree frogs (*Pseudacris triseriata*) 88
Wood frogs (*Rana cantabrigensis*) 48
Jefferson's salamanders (*Ambystoma jeffersonianum*)
Red-backed salamanders (*Plethodon cinereus*) .....in smaller numbers
Newts (*Triturus viridescens*)

They were snuggled together in little groups or clumps in small depressions or cavities in the ground under the leaves. This was on November 9, 1924, at Iosco, Livingston County. It was a cold day following some mixed cold and warm weather, and the weather thereafter was mostly cold. It seems a fairly safe inference that these amphibians would have stayed there for the winter. But it can, of course, only be surmized whether all or any would have survived the winter there. Under some possible combinations of weather conditions it is conceivable that all might have perished during the winter.

The latest autumn date for finding *Hemidactylium* was December 1 (1921) when I found two under small pieces of old wood. It was a mild day following much cold weather in November. The only other date later than November 9 on which I have collected *Hemidactylium* was November 16 (1924). This was a very cold day and snow was falling. All but two of 55 individuals collected then were young of the year. Possibly many of this age may not work their way into sufficiently protected situations to survive the winter.

A rather favorite place of this species in late autumn is the system of channels to be uncovered by kicking over a small rotted stump. I have often reached into such places, where the roots of the stump had decayed away, and brought forth several four-toed salamanders.

All of these late autumn collecting experiences have been repeated on other occasions to lesser extents, and have led to the idea that these salamanders often congregate in late autumn in places where they will remain through the winter. Frequently these are channels or crevices in the ground, into which they crawl.

Spring collecting has tended to verify this conclusion. For example, on April 20, 1923, six days before the first eggs were recorded at that locality (in Pittsfield Township), a dry stick on the oak leaves covering the floor of the woods was kicked aside. One scratch at the leaves where the stick had been, uncovered two or three four-toed salamanders close beside a hole about one inch in diameter. The hole led straight downward about ten inches. Under the leaves directly beside the hole about fifteen individuals of *Hemidactylium* of all sizes were disclosed lying quietly together in groups of three to five or six. A few more were found within two feet, making nineteen in all. Since nearly all of these nineteen individuals had empty stomachs they had probably not been foraging this season. Evidently this group of salamanders had only recently come out of winter quarters, presumably from this hole. FRANK N. BLANCHARD, *Zoölogical Laboratory, University of Michigan, Ann Arbor, Michigan.*

ON THE PROPER NAME FOR THE BREVICIPITID FROG *GASTROPHRYNE TEXENSIS* (GIRARD).—In recent years all of the brevicipitid frogs of Kansas and Oklahoma have been considered as *Gastrophryne carolinensis* (Holbrook), quite probably in part due to the fact that earlier records of that species were available from localities comparatively near in Missouri (Hurter, 1911), Arkansas (Hurter and Strecker, 1909; Strecker, 1924) and Kansas (Cragin, 1881). Cragin (1881), Dice (1923), Burt (1927) and Linsdale (1927) have reported this and no other brevicipitid from Kansas. Ortenburger (1926; 1929) and Force (1930) have reported the same from Oklahoma.

Whether or not all of the Oklahoma records are correct is impossible to state, but the single specimen from that state (Bartlesville, Washington County) in the Dyche Natural History Museum of the University of Kansas, and those from Kansas, are distinctly *Gastrophryne texensis* (Girard, 1860). Numerous specimens from various widely scattered localities in Kansas have been examined—Anderson, Chase, Douglas, Jefferson, Labette, Montgomery and Riley counties. They have been compared with typical specimens of *carolinensis* and *texensis* from Florida and Texas respectively, and are undoubtedly of the latter species. *G. texensis,* then, extends through Oklahoma, and into Kansas apparently to the exclusion of *carolinensis.*

One other Kansas reference to *Gastrophryne* is available—that of Hallowell (1857), who described *Engystoma olivaceum* from "Kansas and Nebraska." For the same reasons given above, this species has in the past been thrown into the synonymy of *carolinensis.* In fact, Cragin (1881) secured his record of *carolinensis* from "Kansas" from Hallowell, and, no doubt, from this description. However, the description is quite obviously of the form which is now known as *texensis*: "The general color above is olive, with dark colored spots posteriorly; *these are observed in considerable number upon the posterior part of the body and upper part of the thighs;* a few also are seen over the shoulders; the sides are obscurely marbled with brown; under surfaces yellow, *immaculate;* a well marked fold passes across the head behind the eyes, extending down alongside of the head." (Italics are mine.) Since the Kansas *Gastrophryne* is not *carolinensis* but is the same as the form known in the past as *texensis,* the latter should be designated as *Gastrophryne olivacea* (Hallowell), which has three years priority over *texensis* (Girard).

The exact type locality was not given in the original description. In all probability the specimen was from Kansas, as, aside from the doubtful type locality, there is apparently no record of the existence of *Gastrophryne* in Nebraska.

Thanks are due Dr. E. H. Taylor and Dr. H. H. Lane of the University of Kansas for their advice in the construction of this note.

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HOBART M. SMITH, *Department of Zoology, Kansas University, Lawrence, Kansas.*

NOTES ON THE BANDED SALAMANDER (*AMBYSTOMA OPACUM*).—In retrospect how many of our youthful ambitions are unfulfilled. Prominent among those of the writer are dreams of life history studies of salamanders, that were not merely dreams. One relating to *Spelerpes maculicaudus* was published[1] and more or less material was accumulated on *Eurycea bislineata, Ambystoma jeffersonianum,* and especially on *Ambystoma opacum.* Hopes of completing these should have been given up long ago, no doubt, but were not. I was particularly interested in the changes in color and form that take place in the final maturation stages of the larvae. These seem to be rapid, and specimens exhibiting them are rarely collected in the field; they are almost as unobtainable also by rearing captive specimens on account of mishaps that seem to be the rule.

The publication of the recent Noble and Brady paper[2] and of Dunn's[3], years ago, have covered the life-history of *A. opacum* in so thorough a way that not a great deal of my information remains worthy of record.

I have always wanted to see the fact definitely stated, however, that Col. Nicholas Pike, a man of some standing, was grossly unfair in his review of the unassuming contribution of a modest village curate, the Rev. Charles Mann, and was the more guilty of his own charge, that of making hasty statements[4]. From Pike's account and some other evidence, there seems a bare possibility that *A. opacum* produces gelatinous masses of eggs in water in spring like other members of the genus, but the occurrence is so far removed from the often verified autumnal deposition in the beds of desiccated ponds of separate eggs each covered with a thin layer of debris as to seem incredible. I should have said entirely incredible except for the fact that the late Mary C. Dickerson informed me she had evidence of *A. opacum* laying its eggs in water somewhere in New England.

Enough perhaps has been recorded on the season of oviposition, on the number of eggs, and on the character of the nests. The position of the nests in the pond bottoms, however, is of importance as those on the edges or higher parts of the basin may never be covered with water in some years and hence fail to hatch; in fact this fate sometimes befalls the whole laying. It may be far-fetched to say that the female of *A. opacum* broods the eggs, but she does remain with them in many cases for varying lengths of time, and it is possible that the quantity of liquid (water?) she usually contains, and which no doubt contributes to her characteristic plump appearance, is in some way, used to keep the eggs from drying. It would be expected that a freshly spawned female would be lank, and the problem as to how the plumpness and high liquid content are so quickly acquired would be an interesting one to solve.

The females (if it be females; has this point been verified anatomically?), however, do not stay with the eggs indefinitely, but leave as the hibernating season approaches, whether the nests are covered with water or not. The eggs do not last indefinitely; at Salamander Pond near Bloomington, Indiana, where eggs had been present from the middle of October, it was found on December 5, 1903, that there was still no water and, surprisingly, no trace of eggs or larvae. Eggs had been kept in the laboratory throughout and beyond this period. A similar failure was observed in the same pond the following year.

The eggs reduce in size by drying but take up water and expand almost immediately when it again becomes available. They retain their vitality for a long time if merely kept moist, but they do not hatch until covered with water. Various experiments were made in testing this matter, one of which has a graphic sort of interest. A certain number of eggs placed with a definite quantity of water in a flat dish where it merely covered the bottom did not hatch; while the same number of eggs placed with the same quantity of water in a tube where they were covered hatched promptly. So far as I observed rupturing the egg envelopes was always done by the tail, the most movable part of the larvae. The first movements of the larva in the egg are with the tail, and these efforts handicapped by the large yolk mass are peculiar, some of them resulting in an up and down tail-wagging.

[1] *Proc. U. S. Nat. Mus.*, 30, 1906: 67–83, pls. 8–10.
[2] *Zoologica*, xi, 8, 1933: 89–132, figs. 83–93.
[3] COPEIA, 43, 1917: 40–43.
[4] The pertinent references are: *Bul. 7, Amer. Mus. Nat. Hist.*, July, 1886: 209–212, and *9th Ann. Rep. Smithsonian Inst.*, 1854: 294–295.

Observing that eggs in some of the nests were covered with considerable debris, I tested the ability of the larvae to struggle through such material. I found that when buried beneath an inch of soil and covered with water they hatched and emerged promptly, some within an hour.

The larvae survive experimental drying carried to such a point that the body surface seems glazed, the folded-over tail sticking to it so that it does not loosen until some time after water is again supplied. Their tenacity of life was shown by some larvae enduring this sort of treatment repeatedly.

Larvae will hatch at a comparatively early stage (11 mm.) when they still contain much yolk and are very feeble swimmers; at this age there are no costal furrows, balancers are present, and stumps of the fore-limbs but no trace of hind legs. On the other hand they will continue to grow (18 mm.) in the egg until the balancers are lost, costal furrows and all of the toes of the fore leg plainly developed, and buds of the hind legs evident. A balancer of a 16 mm. larva taken from the egg was observed to drop off, suggesting that they may be lost in normally hatched larvae in this way rather than by absorption.

The development of the toes on the front foot begins with 1, 2, and 3 (counting from the inner) about equally prominent, and 4 coming later; on the hind foot, similarly the outermost or 5th toe is the latest to be developed.

Feeding young salamanders in captivity is sometimes a problem. If a good supply of *Daphnia* and *Cyclops* can be obtained, they are fine for a first food. When larger food can be utilized, it was found that of a miscellaneous assemblage of small aquatic creatures, the larvae of *Corethra* first disappeared, and in turn small, then larger *Corixa*. Beetles, even such small ones as *Haliplus*, did not seem popular. Cannibalism, first evident in the nibbling of gills or toes, regularly occurs in captivity and as soon as a few larvae achieve the capacity of swallowing smaller ones, they grow by "leaps and bounds." When the larvae have lost their gills and can be kept in moist vivaria, earthworms are a good food. The salamanders soon learn the excellent device, from the standpoint of conservation of energy, of merely seizing and holding on while the earthworm crawls down, to the great delectation, we assume, of the ambystomine interior.—W. L. McAtee, *200 Cedar St., Cherrydale, Virginia.*

NOTES ON THE SNAKE DANCE OF THE HOPI INDIANS.—Through the courtesy of Mr. Glover Ruckstell and the Grand Canyon Air Lines, the writer was able to go by 'plane from Grand Canyon National Park to the Hopi Indian Reservation in northern Arizona to see the presentations of the snake dance at Shongopovi (Shimopovi) and Hotevilla on the 24th and 25th respectively of August, 1932. Data of a herpetological as well as of an ethnological character were secured and it has seemed worthwhile to present the following notes.

Klauber ('32), in *A Herpetological Review of the Hopi Snake Dance,* presents a summary of the entire ritual, a detailed discussion of the snakes used and the methods employed by the Indians in handling rattlers. This excellent report, based upon numerous observations made in past years by others as well as upon personal observations made by Klauber at the 1931 Mishongnovi dance, was used as guide in planning, more or less, what further investigation it seemed possible for the writer to make.

Species Used in the 1932 Dances

At the Shongopovi Dance, with 15 Antelope Priests and 16 Snake Priests participating, a total of 23 snakes were counted as they were received from the *kisi* by the dancers. Of this number, 10 were prairie rattlers, *Crotalus confluentus confluentus,* of two phases. One rattler was the phase which Klauber (1932: pls. 1–3) terms the "large green," while the other nine were "intermediate olive greens." Besides these rattlers, in this dance the priests carried 3 Great Basin striped racers, *Coluber taeniatus taeniatus,* 9 Arizona bull snakes, *Pituophis catenifer rutilus,* and one snake almost certainly identified as *Arizona elegans occidentalis* although it was impossible to examine the specimen at a distance closer than approximately five feet. Certainly it was not *Pituophis.* Klauber (1932: 25) lists *A. e. occidentalis* as one of the snakes possibly occuring on the Hopi-Navajo Plateau and if the Indians resort to digging (this is authentically reported) in their search for serpents, the occasional use of this

nocturnal or crepuscular subspecies would be expected.

At the dance at Hotevilla on August 25, 8 Antelope Priests and 14 Snake Priests participated and 30 serpents were used. This time, however, out of 12 rattlers, 9 were the "large green" phase of *C. c. confluentus* while only 3 were the "intermediate olive greens." None of the "small red" phase seen by Klauber in the 1931 Mishongnovi Dance was observed in either 1932 dance viewed by the writer, although it might be remarked that these phases are easily distinguishable. Other snakes used in the Hotevilla Dance were 16 *P. c. rutilus* and 1 *C. t. taeniatus.*

At the Shongopovi Dance, turtle-shell rattles worn strapped to the leg were all made from the shells of *Clemmys marmorata,* the California mud turtle, with the exception of three, one of which was a small desert tortoise, *Gopherus agassizi,* and the other two were box tortoises, *Terrapene ornata.* No turtle-shell rattles were used at the Hotevilla Snake Dance.

Condition of a Rattler Used in the Dance

At the conclusion of the dance at Shongopovi, the snakes were carried off the mesa as described by ethnologists. Mr. Allan Cameron and the writer, leaving the mesa somewhat behind two of the priests who were carrying the snakes, were able to keep sufficiently close to the priests so that with the aid of a small telescope it was possible to observe exactly where the snakes were liberated. They were not merely turned loose in the fields; they were carefully placed in cracks or crevices of a remnant of sandstone which served as a shrine. This was located approximately a hundred yards from the foot of the mesa. In front of the shrine was a Snake Paho or prayer stick (constructed of feathers, wood, string, and corn husks as described by Fewkes (1898: 983) thrust part way into the ground and sprinkled with sacred meal.

The shrine was approached shortly after the priests had left it, and a rattlesnake and a bull snake were located, not without considerable search, in a vertical crack which extended several feet into the rock. Other snakes deposited at the shrine had almost certainly crawled into another, larger, hole near the base of the rocks. (Further evidence of this was the presence of a racer at the entrance to this hole on the following day when the shrine was re-visited.) However, when the two snakes were discovered, their bodies drawn up in sinuous curves to wedge themselves tightly in the crevice, we wasted little time in further observation. The bull snake, since there was little to be learned regarding it, was left unmolested, but the rattler, one of the "medium greens," was deposited in a small sack carried along for the purpose and we hastily left the vicinity of the shrine. In the sanctum of a gully not far from the shrine, a stop was made to examine the rattlesnake in case anything were to happen which might not later allow us the opportunity to do so. From Klauber's observations, and from the accounts of most ethnologists (except Curtis, 1922: 136) I fully expected to find the venom apparatus intact. Therefore, it was something of a surprise, upon prying the snake's mouth open with a pencil, to find the fangs entirely lacking and obviously removed. With the object of learning something regarding the condition of the venom glands, pressure was applied with the thumb and finger to the proper region, but no venom, at least none recognizable as such, was forced out into the mouth. Of course, with the fangs removed, it would be difficult to observe and identify a discharge of venom.

Owing to the fact that I was unable to leave the Painted Desert region immediately, it was over two weeks after its use in the dance that the rattler was sent to Mr. L. M. Klauber in San Diego, California, for his examination. At that time (Sept. 13, 1932) it was in fair condition, not lacking in spirit, but behaving nearly as it had the day following its use in the dance. Mr. Klauber examined the snake on September 15 and I quote from his letter of September 16, 1932:

> I pickled the snake last night and found as you had supposed that apparently not only the functional fangs had been removed, but all of the rudimentary fangs as well. In fact, it would appear that the sockets in the maxillary which normally hold the functional fangs, were completely extirpated. This has been done with a knife as indicated by cuts rather than tears, and on the whole it was rather well done, if you forget the snake's feeling in the matter. However, an infection had set in which had already reached one of the pits on the outside. I presume that a snake under such circumstances would inevitably die, particularly as it could get no food, even though it might survive the infection. Offhand, it doesn't seem to me that the underworld gods would be disposed to send too much rainfall in return for so damaged a Western Union messenger. I did not make a dissection to determine whether the venom glands were also removed, but this, after all is immaterial with the fangs so completely gone.

The removal of the rudimentary fangs in the snake is a rather surprising discovery inasmuch as no one seems to have suspected the "primitive Hopi" of possessing sufficient knowledge to perform such an operation on a live rattler. Curtis, who raised the strongest dissenting voice concerning the treatment of the snakes, secured the confession of a priest who said the fangs were broken off with the thumb-nail when the rattlers were caught. Klauber, commenting on the Curtis theory states, "The breaking off of the functional fangs would be of doubtful efficacy in any case unless the Indians removed the reserve fangs which involves a very delicate operation."

Unfortunately, only the single rattler used in a snake dance was secured, for after the Hotevilla presentation my attempt to "collect" another was frustrated. Since Dr. H. C. Yarrow in 1883 secured two rattlers after a snake ceremony which when examined by Dr. S. Weir Mitchell at the National Museum were found with fangs intact and venom glands full, since Yarrow found the fangs intact in a specimen examined just prior to its use in a dance, and since both Klauber and his son at the 1931 dance observed the white fang sheaths, evidence that the fangs were intact and advanced, when independently they saw mouths of rattlers open, it cannot be stated with anything like assurance that such expert defanging as was done on the snake secured in 1932 is usual. While evidence in this one case is conclusive, there are the following possibilities: (1) Such complete defanging is a recent change in the ritual. (2) Such defanging is practiced at Shongopovi only. (Presentations of the snake dance as given at each of five Hopi villages are known to be different in minor particulars.) (3) Only the rattlers used by the neophytes are defanged. (4) If such skillful defanging is practiced at one village, some other protective measure, such as plugging the hollow fangs, or "milking" the snakes of their venom as suggested by Klauber, while only a dubious possibility, may be used in other villages. Examination of one additional rattler used in a snake dance held at a village other than Shongopovi would furnish a basis for answering most of the questions raised by these possibilities. The rattler from Shongopovi is now in the collection of the University of California at Los Angeles.

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C. M. Bogert, *1618 So. Gramercy Pl., Los Angeles, California.*

A LIZARD FROM CUBA.—Doctor Carlos G. Aguayo, one of the most talented young naturalists of Cuba and sometime a welcome student here, sent me a specimen of *Sphaerodactylus* with the remark that he had never seen anything like it in Cuba. He was entirely correct for no one else had either.

I surmised at once upon seeing the specimen that it was *Sphaerodactylus gibbus*, a species which I described from the Exuma Cays in the Bahamas some years ago. My colleague, Arthur Loveridge, made a careful comparison with the material and confirms my identification, thus adding another new species to the fauna of Cuba.

Doctor Aguayo has very kindly presented this specimen to the Museum of Comparative Zoology. He found it June 4, 1933, at Calabazas, near Holguin, Province of Oriente, Cuba.—Thomas Barbour, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

OVER WINTER EGGS OF THE SNAPPING TURTLE.—The snapping turtle, *Chelydra serpentina*, is very common in the lakes and swamps of Leeds County, Ontario. A clutch of eggs of this species was ploughed up on October 11, 1931, near Black Rapids and the writer was able to examine them. Five eggs were sent to the Royal Ontario Museum of Zoology. These were identified by Mr. E. B. Shelley Logier. Several others were opened and found to contain living embryos. In the spring of 1932 an effort was made to see if the remainder of the eggs hatched but was unsuccessful due to the disturbance of the ground in planting.

Apparently, in some cases, the eggs of this turtle are carried over the winter

in the ground. Mr. Logier says that this condition has been noted occasionally in the map turtle and in the painted turtle, with belated young emerging in May or June of the following year. More confirmation as to its occurrence in the snapping turtle should be noted before it can be definitely stated that the embryos survive the winter in the egg.—G. C. TONER, *Queens University, Kingston, Ontario.*

A SPECIMEN OF *RANA TARAHUMARAE* FROM NEW MEXICO.—Until 1931, the frog, *Rana tarahumarae* Boulenger, was known from only six specimens, cotypes, from two localities in the Sierrae Tarahumare in western Chihuahua, Mexico (Kellogg, Bull. U. S. Nat. Mus., 160, 1932: 214). The first reported occurrence of this species in the United States was by Berry Campbell (COPEIA, 1931: 164) who found a colony and collected three individuals, June 18, 1931, near Peña Blanca Springs, Santa Cruz County, Arizona.

Recently, while moving specimens, I came across a frog in the Museum of Vertebrate Zoology which had never been identified, and which proves to belong to *Rana tarahumarae*. It was taken, November 12, 1917, one mile above the XSX Ranch, East Fork of the Gila River, Socorro County, New Mexico. The specimen was found and donated to the Museum by J. E. Law (orig. no. 6157, now no. 7992).

The present specimen agrees with descriptions of the species given by Boulenger in his *Monograph of the American Frogs of the Genus Rana* (Proc. Amer. Acad. Arts and Sci., 55, 1920: 468-469) and by Kellogg (*loc. cit.*). It shows dimensions as follows: Head-and-body length, 49 mm.; transverse diameter of tympanum, 2.9 mm.; transverse diameter of eye, 5.6 mm.; anterior edge of eye to nostril, 4.0 mm. The tibio-tarsal joint reaches to barely beyond the nostril when the hind limb is extended forward along the body. There is no dorso-lateral dermal fold. Upper parts are pale brown (in alcohol) with a slight tinge of olive, marked with darker small spots and dark crossbars on upper surfaces of thigh, tibia, and tarsus and on forearm. The throat is heavily mottled. Ventral surface is white, with pale yellow on posterior portion and hind limbs. The skin of the dorsal and lateral surfaces of the body is roughened with fine papillae each ending in a fine point and dark in color. The ventero-posterior surface of the femur is covered with flat granules.

In addition to providing the third general locality of occurrence for the species, the second for the United States and the first for New Mexico, this specimen aids in more complete definition of the characters of the form. As has been pointed out previously the resemblance of all the known individuals to the species *Rana boylii* indicates close relationship between the two populations. In fact, the chief reason for not considering the Mexican form as a subspecies of *Rana boylii* seems to be the distance which separates their known, present-day ranges. Possibly when more specimens of *Rana tarahumarae* are discovered and the characters and range come to be better known it will be considered conspecific with the species nearer the Pacific coast. It may be pointed out that *tarahumarae* resembles *boylii* in many more characters than may be used to separate the two forms.—JEAN M. LINSDALE, *Museum of Vertebrate Zoology, Berkeley, California.*

THE LEAF-NOSED SNAKE IN SONORA, MEXICO.—On June 1, 1926, a specimen of *Phyllorhynchus* was found by Charles L. Camp at Alamo Muerto, thirty miles west of Caborca, Sonora, Mexico. This specimen is now number 10170 in the reptile collection of the Museum of Vertebrate Zoology. The locality of capture is near the western boundary of the state and is only about thirty miles over the line from the Arizona boundary.

This individual shows characters as follows: Scale rows, 19; gastrosteges, 156; urosteges, 34; anal plate, undivided; supralabials, 6; infralabials, 8; preoculars, 2; postoculars, 2; dorsal spots on body, 31; one row of lateral spots present; spots on tail, 6; length of body, 310 mm.; length of tail, 51 mm.; ratio of tail length to total length, .14. The dorsal scales are all slightly keeled.

Comparison of the detailed characters of the present specimen as shown above with those of a leaf-nosed snake from San Ignacio, Lower California, also in this Museum (see Univ. Calif. Publ. Zool., 38, 1930: 376) shows that the two individuals agree in practically every feature except presence of keels on the posterior dorsal

scales. Even this difference is not well-marked; close scrutiny is required to detect the keels.

For many years the genus *Phyllorhynchus* has been considered as composed of two species. The specimens discovered first differed widely in several characters. With the added material now known, although this snake is still uncommon in collections, it is apparent that the range of variability in each form is much greater than was suspected at first. The two supposed species were discussed by Schmidt (Bull. Amer. Mus. Nat. Hist., XLVI, 1922: 686–687) who concluded that the keeling of the scales on the posterior part of the body provided the only distinctive character. The specimens discussed above, together with others that have been recorded in recent years, seem to demonstrate that the forms are really geographic races of a single, rather widely spread, species. In this case the Sonoran specimen would belong to the subspecies *Phyllorhynchus decurtatus browni* Stejneger.—JEAN M. LINSDALE, *Museum of Vertebrate Zoology, Berkeley, California.*

RECORDS OF *ASCAPHUS TRUEI* IN IDAHO.—Since the discovery of the peculiar amphibian *Ascaphus trui* Stejneger in the state of Washington, 1897, knowledge of its range has accumulated until now it is known to occur in a good many localities in Washington, Oregon, and California. When announcing the collecting of a specimen in western Montana, Smith (COPEIA, 1932: 100) predicted that future exploration would reveal the presence of this species in Idaho. Several specimens in the California Museum of Vertebrate Zoology provide records which fill in this gap in the range of this frog and establish its presence in Idaho.

In the summer of 1930, a zoological expedition sent out by Mr. Ralph Ellis, Jr., of Berkeley, California, brought back from Idaho ten specimens of *Ascaphus*. These specimens have been donated to the Museum by Mr. Ellis.

	Date	No. in Mus. Vert. Zool.	Collector
One mile northeast of Heath, Cuddy Mt., 4000 feet altitude, Washington County	June 10, 1930	12336	R. M. Gilmore
	June 17, 1930	12344	A. E. Borell
One-half mile east of Black Lake, 6800 feet altitude, Adams County	July 24, 1930	12337	R. M. Gilmore
	July 25, 1930	12338	R. M. Gilmore
	July 25, 1930	12339	R. M. Gilmore
	July 26, 1930	12340	R. M. Gilmore
	July 27, 1930	12341	R. M. Gilmore
	July 27, 1930	12342	R. M. Gilmore
	July 27, 1930	12343	R. M. Gilmore
	July 30, 1930	12345	A. E. Borell

During the summer of 1932, a specimen of *Ascaphus truei* (Mus. Vert. Zool., No. 15231) was taken, July 1, on the western slope of Cuddy Mountain, 4600 feet altitude, Washington County, Idaho. The general locality represented by these specimens is approximately 175 miles south of and 60 miles west of the Montana locality reported by Smith.—JEAN M. LINSDALE, *Museum of Vertebrate Zoology, Berkeley, California.*

UNUSUAL BEHAVIOR IN A LEOPARD FROG.—For some time I have kept a 26-inch *Thamnophis sirtalis* and a 24-inch *Natrix sipedon* in a four-foot, glass-fronted case in my room. These snakes are fed occasionally with frogs caught along the DuPage River in Du Page County, Illinois. On July 26 ten frogs, eight half-grown *Rana pipiens* and two adult *Rana clamitans*, were placed in the case at 9:00 A.M. Four hours later, when I observed the case, four frogs (three *R. pipiens* and one *R. clamitans*) remained. While standing in front of the case watching the movements of the inmates, I observed the following extraordinary drama:

The garter snake, in moving laboriously along the smooth floor of the case, accidentally touched one of the leopard frogs with a loop of its body. The frog bleated plaintively, but remained motionless. The snake continued to move, and again its body came in contact with the frog, which bleated again and remained unmoving for an instant. Then suddenly the frog appeared to be seized with a severe ague, the entire body shaking violently for a moment. It then appeared to collapse completely. It dropped from its sitting posture and lay with the body sprawled on the floor, the legs stretched loosely out behind. Thinking the frog had died, I turned it over on its back. Its limp body offered no resistance to being handled. However, the rapid

beating of its heart was easily discernible from the palpitating skin of the pectoral region. The eyes remained widely open the entire time. There were no breathing movements for some seconds. Then the frog started to gulp air irregularly, the heart action slowed down to normal, and the body was intermittently seized with a single violent jerk. About sixty seconds later the frog voluntarily righted itself, appearing quite normal in every respect, and reacting to a light touch on the posterior part of the body by leaping away. Two hours later, when I again examined the case, this frog was dead.[1]

To theorize on this unusual behavior seems futile in the light of our meager knowledge of the physiological and psychological complexes of the batrachia. The explanation which immediately suggests itself is that the frog had previously been injured when seized by one of the snakes. While this theory offers a possible explanation, considerable doubt is cast upon it by the fact that I have never observed either of these snakes to lose a frog of this size, once having seized upon any part of the body. Moreover, a careful examination failed to reveal any marks upon the body of the frog. The assumption that it was a fear reaction is rendered doubtful by the fact that dozens of other frogs failed to respond in a manner even remotely resembling this in situations precisely similar. My experience has been that frogs either exhibit complete unconcern in the presence of a snake, leaping away only when the serpent comes too near; or, when actually attacked, inflate the body to its fullest extent with air, arch the back, and curl the head down between the front legs, remaining stolidly in this posture until they are overpowered or until the snake, finding his prey too bulky to manage, moves away. Behavior so unique seems worth recording.—D. DWIGHT DAVIS, *Field Museum of Natural History, Chicago, Illinois.*

SOME NEW AMPHIBIAN RECORDS FOR OHIO.—In the course of a survey of the amphibian fauna of Ohio several species have been found which had not previously been reported from this state. Two of these, *Gyrinophilus duryi* (Weller), and *Pseudacris brachyphona* (Cope), I have recently recorded elsewhere. For the following species there seem to be no published Ohio records, and for the two salamanders, indeed, no previous records from the region north and west of the Ohio River.

Plethodon wehrlei Fowler and Dunn. On June 28, 1931, I had the good fortune to collect a specimen of this scarce salamander in a hemlock woods along Sunfish Creek, in Monroe County. Another has since been taken in eastern Washington County by Mr. Albert Smith. Both are in the Ohio State Museum collection.

Pseudotriton montanus montanus (Baird). Two adults and four larvae were secured on May 20, 1928, by the late Professor James S. Hine, Mr. George Watters, and myself, from a hillside spring in extreme southeastern Adams County. Other specimens have since been taken elsewhere in southern Ohio, the northernmost record at present being at Byer, in the northern part of Jackson County.

Bufo fowleri Garman. Although there seem to be no references to Ohio specimens in the literature, Fowler's toad occurs widely over the state and in many localities in the southern half it outnumbers *Bufo americanus*.—CHARLES F. WALKER, *Ohio State Museum, Columbus, Ohio.*

NOTES ON *EPICRATES INORNATUS* (REINHARDT).—*Epicrates inornatus* is, as Barbour says, "now a really rare species." I have trailed rumors of it from one end of Puerto Rico to the other, over mountains and swamps, apparently just one jump behind. I have seen two headless skins, 7 feet 3 inches and 7 feet 6 inches long, respectively. There are three poorly mounted specimens in the local museum.

On March 10, 1931, I secured a fine specimen at Piedra Blanca Cliff, at about 1,500 feet elevation on the Luquillo Range, near the northeast corner of the island. This specimen measures 1,610 mm. to vent, tail 215 mm. (end broken off). Ventrals 265, then one paired and two single preanals, one paired postanal, and 52 urosteges

[1] C. M. Breder (Bull. N. Y. Zool. Soc., 35: 31) describes a series of responses by small killifish, used as food, to the approach of a zebrafish (*Pterois volitans*) which resemble the above reactions in several respects, although in this case caused by optical stimulation instead of tactile.

to broken end. Scale rows, neck 37, at one foot 32, at two feet 34, at three feet 38, at four feet 25, at five feet 22, behind vent 18. The specimen is almost black, the spots almost indiscernible. Noteworthy features are the slenderness (proportions of a bullsnake), the ash gray eyes, and the bluish black tongue and inner mouth.

This boa is active, and apparently not panicky. For protection it rolls up in a ball or spherical knot with the head inside and it is difficult to make it unwind. When teased, it throws the first third of the body into a horizontal double "S" and strikes more than the doubled length, with the mouth open, and hissing. In a defensive attitude, when about to strike, the mouth is partly open, the tongue protruding, and the throat inflated so that it appears like a dewlap about the size of the head. The teeth are strong, sharp, and hooked, so that the snake has difficulty in disengaging them after striking.

The boa apparently hunts at night, and remains coiled on a rock or log for the first few hours of sunlight for warmth, then it crawls into its cave or hollow log for the day. When a "jibaro," or peasant, locates a "culebron," he knows he can kill it at any time, as it can usually be found at the same place. Many amusing stories about the boa are current and believed on this island today. Snake oil is in great demand for "medicinal" purposes, but the fat must be extracted from the living snake. Much hog fat is sold by the reputed snake oil sellers. The hind part of the body of my six foot specimen held about two cups of very soft, fine fat.—CHAPMAN GRANT, MAJOR *65th Infantry, 535 Quince St., San Diego, California.*

A GARTER SNAKE ATTEMPTING TO EAT AN ALLIGATOR LIZARD.—While doing field work in Tehama County, California, I made the following interesting observation on the feeding habits of the garter snake. On May 22, 1930, at 11:45 A.M., while exploring a small patch of digger pine timber, a slight rustling in some nearby bushes attracted my attention. Careful approach revealed a garter snake (*Thamnophis*) attempting to eat an alligator lizard (*Gerrhonotus scincicauda*). The lizard had its body passed around a prone dead branch and its tail tightly held in its mouth, thus forming a closed link about the branch. About eight inches of the snake's tail was entangled in a small bush two feet away and its jaws were clamped upon the lizard's neck. The snake was trying to dislodge the lizard and was pulling at approximately right angles to the axis of the stick about which the lizard was linked. It would pull, apparently with all its strength, for one or two minutes, then, while continuing to hold the lizard, completely relax for a similar length of time and then pull again. There was no tugging, each exertion of the snake was steady and the relaxation gradual. At each renewed attempt the snake changed the angle of pull slightly, and by these efforts succeeded in advancing the lizard some five inches along the branch. In the fifteen minutes required for this procedure the lizard did not make a single movement other than that of breathing.

At this time a slight rustling caused by my stepping in leaves resulted in the immediate release of the lizard and the withdrawal of the snake. The lizard continued to lie motionless on the ground with its tail still held in its mouth while I stepped closer and bent over it. It was apparently unharmed, for, when I touched its body, it sprang into immediate action and swiftly ran away.

The snake was about two and one-half feet long and the lizard eight or nine inches. The branch about which the lizard was locked was about four feet long, and was so held by other vegetation that it was not moved across the ground by the efforts of the snake. However, it did permit a small amount of bending, and it was partly because of this bending that the snake was successful in working the lizard almost to the end of the branch.

These observations were recorded at Meadow Ranch, 3½ miles west of Payne Creek Post Office, Tehama County, California. The elevation is 1000 feet.—LAWRENCE V. COMPTON, *Museum of Vertebrate Zoology, University of California, Berkeley.*

Ichthyological Notes

PIMELODUS VALENCIENNIS KR. THE TYPE OF A NEW GENUS.—Two specimens, 158 and 198 mm standard length, of this catfish which apparently few ichthyologists have had the opportunity of examining, have come into my hands in a collection made by Dr. von Ihering in southeastern Brazil. Although doubtless related to *Pimelodus*, its peculiar characters seem to warrant making it the type of a new genus.

Parapimelodus, new genus

Type: *Pimelodus valenciennis* Kr., described by Lütken (Videnskabelige Meddelelser, Kjøbenhavn, 1873–74: 200).

General characters.—Eye strictly lateral or slightly inferolateral, sloping inward under the flat casque. Head depressed from the snout to between the eyes, and deeper than high behind. Adipose triangular, with appreciable rays, over the anal which it about equals in length; its height about one-half its base. Gill-rakers very long and bristle-like, about 70 on lower branch of first arch. Intermaxillary band of minute teeth wider in the center. Elongate patches of slightly larger palatine teeth far remote from this band.

Recent authors are apparently correct in synonymyzing *P. nigribarbis* Boulenger with *valenciennis*. Boulenger's figure (Proc. Zool. Soc., 1891, pl. 25) shows a shorter adipose than that of our specimen, and does not bring out the peculiar character of the eye, shared by a few other unrelated South American catfishes. Lütken describes the eyes as "lying on the sides of the head directly under the edge of the casque, and a little nearer the tip of snout than the gill slits."—FRANCESCA LAMONTE, *American Museum of Natural History, New York City.*

THE ANTIQUITY OF *ALBULA*.—The receipt of Dr. Wm. K. Gregory's splendid work on *Fish Skulls* suggests many reflections, and brings to mind the old question of the age and relationships of *Albula*. The genus *Albula* (*A. eppsi* White and Frost) has been recorded from the British Lower Eocene, but it might well be supposed, on general grounds, to be of greater antiquity. This supposition appears to be verified by the discovery of a typical *Albula* scale in the Cretaceous strata of Florida. I have called it *Albula* ***antiqua*** new species, and it may be defined as a scale about 9 mm long and 10 broad, broadly rounded apically, sides nearly straight; laterobasal angles prominent, a little greater than right angles; fibrillae very close, longitudinal, the basal ones beaded as in the modern *Albula*. A longer account, with an enlarged photograph, is in the hands of the Florida Geological Department, at Tallahassee. Mr. Herman Gunter, who sent the specimen, states that it came from core No. 89 obtained in drilling at the Walton Land and Timber Company well No. 1, about ten miles south of De Funiak Springs, Walton County. The depth is 4067-4073 feet. The associated foraminifera and some other fossils prove the horizon to be Cretaceous.

The scales of *Albula* are very characteristic, and very different from those of the Elopidae. *Dixonina* scales do not differ from those of *Albula*. In referring the fossil scale to *Albula*, it must be with the reservation that it may have belonged to some extinct albulid genus, but at any rate not to any yet described. The evidence from paleontology points to the great antiquity of scale structures and patterns. Thus I have described from the Cretaceous of California a scale which does not differ at all in structure from the living *Pomolobus*. The value of the scales as an aid to classification depends largely on the persistence of their characters, so that we can say that groups of fishes having markedly dissimilar scales cannot be closely related. On the other hand, there has been a certain amount of "convergent evolution", so that similar scales do not necessarily indicate near relationships. But in all such cases, I believe, close scrutiny will show that the similarity is more or less superficial.—T. D. A. COCKERELL, *University of Colorado, Boulder, Colorado.*

REVIEWS AND COMMENTS

TRIMERESURUS TOKARENSIS AND *LATICAUDA SEMIFASCIATA.* By K. Nagai. In Kagoshimeken Hakubutsu-Chosa, pt. 3, 1928: 1-64.—In Japan, the sea snake *Laticauda semifasciata* (Reinwart) inhabits warm currents from Formosa to the middle of Honshû. The most productive fishing ground is located in the vicinity of Seven Islands (Kagoshima Prefecture), which lies between Amamiôshima and Kyushu. In winter, this sea snake comes up to the shores of Iwojima and Kuchino-erebujima, two islands in Kagoshima Prefecture.

Mr. Nagai[1], a teacher of the first middle school of Kagoshima Prefecture, made observations on the breeding habits of this sea snake during 1924 to 1928. It is my purpose here to review some of the data given in his paper published in Japanese in 1928.

Copulation in this species may occur from September to October. During this season, the male is apt to entangle the female or similar inorganic objects such as black rods or sticks. If these are placed in the sea, males will be observed entangling themselves about them. Sometimes one or as many as ten males may wind themselves about a single female, forming a coiled mass.

From the middle of October to the beginning of December, this sea-snake comes into shallow water along the beach of these islands to spawn.

In this connection it is of particular interest that these snakes have been observed to enter regions along the shore of Kuchino-erabujima or of Takarajima where the water is considerably warmed by the influx of water from hot springs.

On the night of October 25, 1924, an observer found two specimens coming up to the sandy sea-shore by swimming through water filled crevices in the rock clefts about the shore. When Mr. Nagai received these two adult specimens on the morning of October 29, he found that three eggs had been deposited in the shipping-container while in transit. More eggs were deposited by these specimens while they were in an aquarium.

The dimensions of five eggs were as follows: length 70 to 82 mm, averaging 76.5 mm; breadth 33 to 35 mm, averaging 33.6 mm. The weight of the eggs varied from 44 to 51 grams, averaging 47.4 grams.

Empty egg cases were found in the shallow water of the limestone cave of Kotakarajima (the water temperature here is about 30°–35° C). It is reported that natives gathering stones in the water along shore for the purpose of building jetties, found two adults under a stone at the high tide mark with three eggs between them. The two individuals thus observed were coiled about the eggs, apparently guarding them.

From these observations it is evident that the eggs are deposited in shallow water, just below high tide mark.

The hatching period may occur at about the middle of January; though just-hatched embryos have not as yet been observed. In general, the young, with a body length of about 420 mm, appear on the sea-shore in April. Some measurements taken of such young are as follows: length 420 mm, weight ?; length 428 mm, weight 28 g; length 438 mm, weight 46 g.

The mode of moulting is closely similar to that of some land snakes. The moulting skin remains intact over most of the body.

Mr. Nagai will continue with observations on this species during succeeding years as opportunity may be afforded to him to go to the Seven Islands. We therefore may expect to have more detailed data on this life history of this sea snake.—YAICHIRO OKADA, *485 Kamiosaki, Shinagawa-Ku, Tokyo, Japan.*

[1] Nagai, K. 1928 "Trimeresurus tokarensis and Laticauda semifasciata" Kagoshimeken Hakubutsu-Chôsa, pt. 3: pp 1–64.

EDITORIAL NOTES AND NEWS

Twentieth Anniversary Number

THIS number of COPEIA completes the first two decades of the journal's history. The Editors are very happy in dedicating this anniversary number to "JACK" NICHOLS, genial founder of the journal and its generous sponsor for years. The following history of COPEIA has been furnished by the Secretary of the Society, M. GRAHAM NETTING:

On December 27, 1913 JOHN T. NICHOLS issued the first number of the journal COPEIA, a folder of 4 pages containing 5 short articles, and 6¼ x 9 inches in size. During 1914 twelve additional numbers (2-13), each of 4 pages, were issued. The number of pages for this year total 48 although the pagination was not indicated in the individual numbers. In No. 10 a note indicates that Dr. Nichols had begun the sale of the journal at a price of 5 cents per copy. During 1915 twelve numbers were again issued (14-25), and the size was increased beginning with No. 18 to eight pages. The consecutive numbering of pages was instituted in the same number and the total for the year amounted to 12 unmarked pages and 64 numbered pages or seventy-eight in all.

On January 1, 1916, there was established a Publication Committee for COPEIA, consisting of JOHN T. NICHOLS, Executive, HENRY W. FOWLER and DWIGHT FRANKLIN. In February 1916, this Committee met and organized a society to advance the science of cold-blooded vertebrates. The Committee elected officers and agreed upon the following name for the organization: THE AMERICAN SOCIETY FOR THE STUDY OF FISH AND REPTILES. On March 2, 1916 a preliminary meeting was held at which By-Laws were adopted for the Society. The name of the Society was changed in the By-Laws to THE AMERICAN SOCIETY OF ICHTHYOLOGISTS & HERPETOLOGISTS. The first regular meeting was held in the American Museum of Natural History on March 8, 1916.

During 1916 thirteen numbers (26-38) were issued, containing a total of 100 pages. The first index covering the period from 1913 to 1917 was issued in December 1917. Thereafter, indices were published annually. On October 12, 1923 Dr. Nichols announced his intention of giving up the editorship of COPEIA, whereupon the Society decided to publish it as its official organ. Dr. E. R. DUNN was elected editor and the place of publication changed from New York to Northampton, Massachusetts. Dr. Dunn continued to edit the growing journal until early in 1930, having changed it to a quarterly publication early in 1927, beginning with No. 162. The last number which appeared at Northampton under his editorship was No. 173.

Shortly thereafter, DR. CARL L. HUBBS was elected Ichthyological Editor and MRS. HELEN T. GAIGE, Herpetological Editor. The new editors changed the format of COPEIA and discontinued the consecutive numbering of issues. The first number of the new series (1930, No. 1) appeared on April 30, 1930 and since that time four issues, numbered 1 to 4, have appeared each year. The size was increased to 7 x 10 inches, the paper was improved, and the quantity of material published increased materially. It must be noted that the sudden increase in the size of the journal was largely due to the diligence with which Dr. Hubbs secured new members during the years 1929 and 1930 when he was Secretary of the Society. The especial Jordan Anniversary Number was published as No. 4 for 1930 and the total number of pages for that year amounted to 170. In 1931 under the same editors, 174 pages were printed, including the especial Stejneger Anniversary Number, and in 1932 the continuing increase in size reached 196 pages for the year. The place of publication was changed to Ann Arbor, Michigan when Dr. Hubbs and Mrs. Gaige became the editors, and the dues were raised to $3.00 per year on January 1, 1932 in order to properly support the increasingly important journal. During 1933, although seriously hampered by adverse financial conditions, 224 pages are being published. The generosity of many of our members makes possible the present Twentieth Anniversary Number.

Recent Deaths

DR. HOWARD AYERS, formerly President of the University of Cincinnati and professor of biology at the University of Missouri, and known for his fine work on the comparative anatomy of fishes, died on October 17, at the age of 72.

WILLIAM DE CHASTIGNIER RAVENEL, early connected with the Fish Commission and for many years an official of the National Museum, died on October 8 at the age of 74 years.

Herpetological Items

THE Toledo Zoological Society is receiving federal aid under the C. W. A. for the building of a reptile house, which was started in December. A description of the building will be given in a later number.

GORDON L. WALLS has joined the staff of the Zoology Department, University of Iowa (Iowa City) where he will continue his researches on reptile eyes.

It is well known that Mr. ARTHUR LOVERIDGE has long been interested in the relation between the animals in the West African rain forest and those of relict area of rain forests existing in the mountains of East Africa. Now with the aid of a grant from the John Simon Guggenheim Foundation, and other sources, he has returned for another year's journey to study especially the fauna of Mount Elgon.

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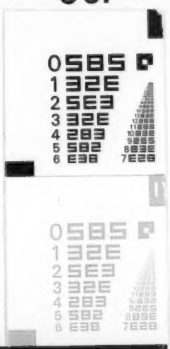
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